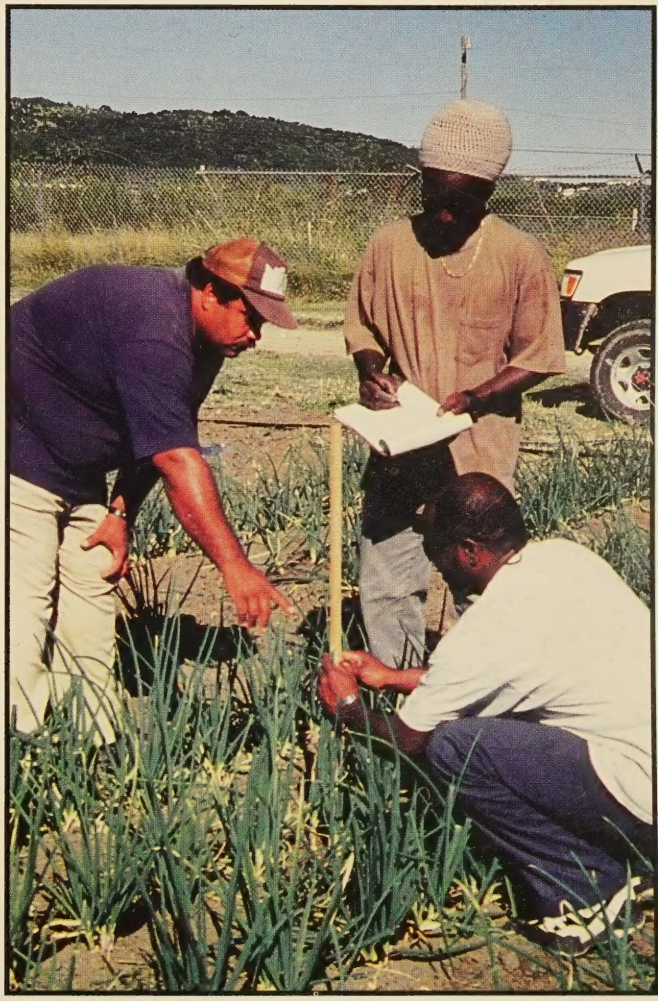
Southern Region 1996 Annual Report

Sustainable Agriculture Research & Education



Around the Region in 1996

Ellen Polishuk, manager of Potomac Vegetable Farms demonstrates windrow composting of municipal and agricultural wastes as part of a SARE project conducted through Virginia Tech. (Project LS95-71)

USDA/NRCS personnel conducting an annual inspection of constructed wetlands in Alabama. (Project AS94-14)

Bill Wilson checks the development of nuts on his native pecan trees in Arkansas. (Producer Project PG95-32)

Tom Trantham explains his successful grazing system to top USDA officials, other farmers and extension agents during a field day at his South Carolina dairy farm. (Project LS93-54)

Livestock and forestry specialist Thomas Jessup feeds pastured swine at Arkansas Land &Farm Development Corporation farm. Photo by Arnold Smith. (Project LS95-67)

Katharina van Santen inspecting a plot of lupin at the Plant Breeding Unit of Auburn University in Alabama.Photo by Edzard van Santen. (Project LS94-62)

(Above) Integrated Pest Management Scout Schools for ornamentals and turf were conducted on St. Simons Island and at the Georgia Station in Griffin. The 190 participants from 43 countries included extension workers, Master Gardeners and representatives from all aspects of the nursery and landscaping industries. Photo by Sharon Omahen. (Project AS95-23)

Juan Villanueva-Jimenez (left) evaluates citrus leafminer damage on nursery trees in Florida. (Project AS95-24)

It's about time

For a South Carolina dairyman who was nearly broke 10 years ago, 1996 was a bang-up year. My dairy, in its third season as a SARE grazing system project through Clemson University, is proving what I knew in my heart at the beginning—sustainable systems work. Because that system works, I have more time. Time to enjoy my cows instead of worrying about staying ahead of their feed bills. Time to spend with my family. Time to serve the Southern Region Administrative Council as their 1996 chairman. Time to speak at conferences sharing what I've learned from my grazing experiment. Time to accept phone calls from producers around the country seeking advice or just wanting to say that my success has given them hope for their own operations.

I had the time to accept an invitation to tell USDA Secretary Dan Glickman about the difference sustainable agriculture has made in my life. That meeting resulted in Secretary Glickman issuing a letter stating USDA's commitment to sustainable agriculture. It all culminated in Deputy Secretary Richard Rominger choosing my farm from which to officially issue that statement. He showed up on a brilliant October day as I hosted an extension training in the morning and an afternoon bar-be-cue for farmers who had participated in the original Haylift.

Mr. Rominger climbed aboard a haywagon along with the extension trainees, National SARE Director Rob Myers and Southern Region Program Manager Paula Ford for a tour of my entire grazing operation. The diverse crowd in that wagon represented every segment of SARE's constituency. It was a proud moment for this dairyman.

Even if I had managed to stay in business using my old conventional dairying methods, I wouldn't have had the time or energy to do any of the things that led to that bright October day. Sure SARE research is about helping farmers earn a safer, more profitable living. But just as important, SARE research is about time—quality time to give to family, friends, community and myself.

Tom Trantham, 1996 Chair
Administrative Council

What is SARE?

SARE was initiated in 1988 and is currently authorized under Chapters One and Three, subtitle B of title XVI of the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA) to promote research that expands knowledge about sustainable agriculture systems.

The mission of the SARE program is to stimulate research and education activities that will increase knowledge and extend information about sustainable agricultural systems.

SARE funds three types of projects:

Research and Education Projects were the original recipients of SARE funds in 1988. These generally are led by interdisciplinary, multi-institutional, multi-state research teams that include farmers as participants. These projects are administered jointly by the University of Georgia and Fort Valley State University.

Producer Grants were started in 1994 to take advantage of producer experience and knowledge. These projects are designed and conducted by producers. Funded for up to $10,000, they are generally located in one state, often on one farm. These projects are administered jointly by the University of Georgia and Fort Valley State University.

Professional Development Projects were implemented in 1994 to train agricultural information providers in sustainable agriculture techniques and concepts. These projects are administered by North Carolina State University, ATTRA and North Carolina A & T University.

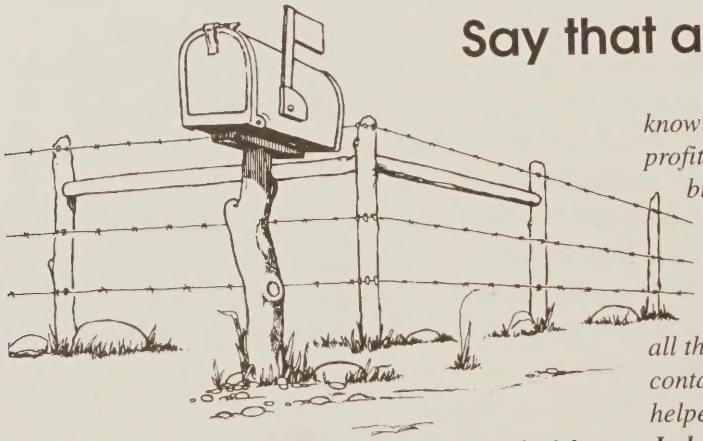
A program apart

Farmer first. End-user up front. Participatory decision making. However you say it, the SARE program is unique among grant programs because of the farmers who help guide it. Farmers serve on the Administrative Council along with the representatives of state and federal agriculture departments, scientists, universities, industry officials and non-governmental agencies. Together these volunteers determine policy for Southern Region SARE, including priority research areas for funding.

When proposal review time rolls around each year, farmers are among the 100 or so people who review preproposals. The reviewer evaluations determine which preproposals will be selected for development into full proposals. The full proposals are read and evaluated by the Technical Advisory Committee, which also includes farmer members. After each member has evaluated the full proposals, the Technical Advisory Committee members meet to discuss the technical merits of each proposal. At the end of the meeting, they make a list of the top-ranked proposals.

The proposals recommended for funding by the Technical Advisory Committee are then reviewed by the Project Review Committee of the Administrative Council and referred to the Administrative Council for final approval. Farmer members of the Administrative Council also are well represented on the Project Review Committee, which has the responsibility of investing more than $1.5 million in research funds annually. Consequently, farmers participate in every step of the process from drafting the Call for Proposals to the final selection of new projects.

Besides playing a major role in selecting SARE research projects, farmers also participate as cooperators on projects led by institutional researchers. Along with extension staff, crop consultants and other agricultural professionals, they participate in training sponsored by the SARE Professional Development Program. They even design and coordinate on-farm research projects through the Producer Grant Program.



Say that again?

"It was through SSAWG that we learned of the SARE program and developed an understanding of how important it is for farmers to participate in on-farm research if research is to produce results that can fit into a farming system" ***Jean Mills, farmer, Alabama.***

"Cooperating on projects like this broadens my own expertise through on-farm experience. They don't teach this kind of application in school. This knowledge will allow me to help our farmers make a profit. If they can't make a profit, they can't stay in business." ***Bob Boland, director Brantley County Extension, Georgia.***

"The fact that we had written a successful grant proposal and carried through with all the record keeping convinced experts and other contacts that we were serious, which has, in turn, helped our research project become a business." ***Judy Stamback, farmer, Oklahoma.***

"USDA's goal for producers to advance their own technology through SARE is novel and farsighted. With the constant threat of pesticide resistance, new, introduced pests and a changing regulatory environment, this important program provides further incentive for growers to advance IPM-sustainable farming methods." ***Dr Charles Mellinger, crop consultant, Florida.***

Research and Education Project Summaries

SARE
Sustainable Agriculture Research and Education
Southern Region

LS93-51
Final Report
December1996

Warm-Season Forage Grasses as Rotations for Sustaining Profitable Peanut Production

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Objectives

The potential use of a warm-season forage grass for controlling peanut pests and for use as livestock feed offers a novel approach to sustainable agriculture. The principal rationale of this research is that switchgrass can be used as a forage grass rotation to enhance sustainability of farms engaged in mixed peanut/cattle production.

The long-term goal of this project is to develop profitable and sustainable peanut production systems that will suppress nematodes and other soilborne pathogens, reduce or eliminate pesticide use and enhance cattle production.

Specific objectives are to

1.) Assess the potential of peanut rotations with switchgrass to suppress infection by root-knot nematodes, aflatoxigenic fungi and other soilborne pathogens of peanut within integrated peanut and forage-livestock production systems.

2.) Study the effect of selected warm-season forage grasses on populations of nematodes, aflatoxigenic fungi and other soilborne pathogens of peanut.

3.) Evaluate the level and variability of implied net returns from all treatments if adopted on a commercial scale.

4.) Determine the impact of switchgrass and other selected warm-season forage grasses on beneficial soil microbial communities.

Approach

Field trials were established in 1992 for rotation/production system studies. These three year rotations included continuous peanut, switchgrass-peanut, continuous switchgrass, cotton-peanut and cotton-cotton-peanut. Peanut and peanut-switchgrass rotations were planted both with and without nematicide (aldicarb) as an industry standard control. Field trials were used to assess the potential of switchgrass rotations to suppress root-knot nematodes and aflatoxigenic fungi and to assess microbial population shifts with crop rotation under field conditions.

Nematodes were sampled prior to harvest, when populations are highest. Aflatoxigenic fungi were assessed at two week intervals throughout the growing season. Soil microorganisms were sampled at three times during the growing season. Evaluation of shifts in microbial populations and species diversity were used to assess environmental impacts and sustainability of forage grass rotations for disease control. Yield data were collected from field experiments.

A series of microplot experiments was established to more closely investigate the effects of forage grass-peanut and forage grass-cotton rotations on nematode populations and soil microorganisms. Microplots were sampled for nematodes at planting and before harvest. Methods utilizing nematode eggs in alginate films were developed that allowed for the evaluation of the effects of shifts in soil microbial ecology with cropping system on nematode eggs in microplots.

Enterprise budgets were developed using yield and input data. Enterprise budget computations were made across all treatments and replications. Net return results were analyzed to determine differences in potential business profits. Analyses included business returns for existing producers as well as new entrants. Procedures were used to trace the trade off between return levels to return variability. Results allowed conclusions to be drawn concerning adoption of nematode control strategies by risk averse, risk neutral, risk seeking entrepreneurs.

Results

The results of nematode isolations indicate that in field trials, switchgrass and cotton did not support populations of root-knot nematode. Switchgrass supported higher populations of nonparasitic (beneficial) nematodes than cotton. Peanut with no nematicide following two years of switchgrass provided the same nematode control as continuous peanut plus nematicide.

Experimental results do not lead to any firm conclusion that switchgrass rotations can minimize invasion of peanut seed by aflatoxigenic fungi. However, the data does support the hypothesis that particular rotation sequences can contribute to minimizing peanut seed invasion by aflatoxigenic fungi and subsequently minimize aflatoxin contamination of the peanut crop.

Microbial populations in field trials indicate that switchgrass supported lower numbers of

Project area
IPM

Project duration
March 1993-Dec. 1996

Budget

SARE	$183,000
ACE	
Matching	$48,520

rhizosphere fungi than peanut throughout the season and a distinctly different bacterial microflora compared to continuous peanut and peanut following switchgrass. These shifts in bacterial populations are consistent with previous results where similar shifts resulted in soils being suppressive to one or more pathogens, including root-knot nematodes and *Sclerotium rolfsii*.

Results of microplot studies indicate that switchgrass reduced egg viability and juvenile emergence, increased the number of eggs parasitized by fungi or bacteria and reduced the number of root-knot nematode juveniles in soil compared to peanut or cotton in microplots.

Overall, alginate films containing eggs placed in microplots planted to grasses had fewer viable eggs and more parasitized eggs than films placed in plots with peanut, indicating an altered soil microflora antagonistic to nematode eggs. Significantly fewer J2 hatched out of eggs from films placed in grass plots.

Peanut yield did not differ among treatments in field plots in 1993 or 1994. In 1995 peanut plus nematicide in a one-year rotation with switchgrass had significantly higher yield than continuous peanut, either with or without nematicide. In 1996 only the continuous peanut treatments, both with and without nematicide, were planted to peanut.

Consequently, no data on the effects of peanut-switchgrass rotation on peanut yield were collected during this year. Economic analysis indicates that in the present situation where farmers can sell quota peanuts at prices that are fixed by the USDA, the farmer would choose to plant half of his land in continuous peanut with nematicide and the rest in two years of cotton followed by additional (nonsubsidized) peanuts.

To compare this with switchgrass based rotation, the analysis forced only rotation patterns containing at least one year of switchgrass in the rotation practice. It was observed that the profit was reduced almost 1/3 of the former level. On the other hand, in this situation the farmer used much less chemicals.

The other conditions analyzed in this study was with the assumption of complete elimination of the peanut program. When quota was eliminated, farmers would still choose not to plant switchgrass because of lower profit potential. Because the farmer places higher utility to profit than environmental amenities, switchgrass was not included in the rotation practice. When switchgrass was forced into the rotation practice with a complete quota elimination situation, the farmer decided not to plant any crop.

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Southern Region

LS93-52
Annual Report
December1996

Utilization of Dairy Manure in Low-Input, Conservation Tillage Animal Feed Production Systems

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Objectives

Animal manures represent valuable resources in an agricultural cropping system. When returned to the land they provide relatively available forms of N, P and K for crops. However, problems occur with the application of these resources. It is difficult to know how much manure to apply to a given piece of land, and over-application transforms that resource into a potential problem. Over-application can result in the loss of excess nitrate N to shallow subsurface waters or loss of P to surface water. One common problem is the application of manure to fields to dispose of it, followed by applications of inorganic fertilizers to ensure good crop growth. This represents a waste of resources and capital to the farmer. Manure application recommendations in the state of Tennessee are based on information from other regions of the USA. This research will help to refine recommendations for Tennessee and hopefully, the mid-South region.

The objectives of this research project are to look at the long-term residual impacts of manure applications on corn silage growth and soil properties, as well as the impact of manure applications on off-site surface and subsurface water quality.

This is being accomplished through the use of field plots at two state agricultural experiment stations and two cooperator farmer locations. The experiment station sites are the Martin Agricultural Experiment Station in Martin (northwest Tennessee) and the Dairy Experiment Station in Lewisburg (south-central Tennessee). The plots at Martin have not received previous applications of manure, while the Dairy site has been manured frequently for nearly 40 years. The farm sites are both working dairies, one near Martin and the other south of Lewisburg.

Approach

In order to evaluate residual availability of N on manured plots, plots were established in 1993 at the Experiment Station sites and in 1994 at the farmer sites. The experiment at the experiment stations consists of 17 treatments: a 0-fertilizer check, three rates of N as NH_4NO_3 (75, 150 and 225 lb N/acre) and three rates of manure N (100, 200 and 300 lb manure-N per acre applied for either:

1.) Three consecutive years, or

2.) Two consecutive years with no application in year three, or

3.) The first year with no application for years two and three.

To provide a tillage comparison, the 150 lb inorganic N and the 200 lb manure N treatments applied for one, two, or three years were established with conventional tillage (chisel + disk + harrow) and no-tillage.

Manure rates were derived using the assumption that 75 percent of the N applied as liquid cattle waste would be available for plant use in year one (Pratt et al., 1973). This results in an estimated availability of 75, 150 or 255 lb N per acre, which matches the inorganic rates. The 150 lb/acre rate corresponds to the high end recommended rate of fertilizer N for corn in Tennessee.

Inorganic P_2O_5 and K_2O are applied to the inorganic fertilizer N plots according to soil test recommendations. Manures and fertilizers were applied prior to tillage and planting operations. Smaller versions of this experiment have also been established on two cooperator farm sites, one in each region. The treatments were scaled down to the following 11 no-tillage treatments: the 0-fertilizer check; the 150 lb NH_4NO_3 N/acre treatment; and the 100, 200 and 300 lb manure N/acre treatments for one, two or three years.

To evaluate manure impacts on water quality, a second series of plots were established at each station. Treatments at the Martin site include four rates of liquid dairy manure (113, 225, 338 and 450 lb N/acre), one NH_4NO_3 rate (195 lb N/acre) and a control (0 lb Nlb/acre. At Lewisburg, the 338 lb N/acre manure treatment was omitted due to lack of space. The applications range from deficient to excessive N rates; however, the high application rate is not uncommon for dairy operators in these areas.

Corn for silage is no-till planted on all plots each spring, followed by an annual ryegrass-clover winter cover at Martin and orchardgrass cover at the Dairy Station.

Project area
Livestock systems

Project duration
March 1993-Dec. 1997

Budget

SARE	$90, 635
ACE	
Matching	$36,123

Instruments were installed beneath each plot (at a depth of three feet) to collect water leaching through the soil and out of the root zone. After every storm, leachate is analyzed for nitrate-nitrogen and other constituents, such as phosphate.

Results

The data for the residual experiments indicate that prior manuring history will affect the availability of N. At Martin, yields of silage corn were much lower for second and third year corn grown on plots receiving manure only during 1993. For soils receiving manure for two years, the yields in the third year were still well below those for normal rates of inorganic-N applications (150 lb N). Manure applications of 200 and 200 lb N for three years resulted in yields equal to those from the inorganic control. however, there was little impact of three years of manuring on silage produciton in the fourth year. Fourth year yields were significantly lower from plots receiving 300 lbs manure-N for three years than from those receiving the inorganic N.

However, the soils at the Dairy Station have received manure for many years and have shown no response to added fertilizer or manure-N for the past four years. Soils with no manure or fertilizer application have consistently produced silage yields equal tothose from soils receiving 225 lb fertilizer N. This site has been manured for nearly 40 years and illustrates the potential for over-application of nutrients when using both animal and inorganic sources of N simultaneously for a number of years.

Both on-farm locations observed good yields with applications of 200 lb manure-N/acre after three years. There were no statistically significant differences between the 150 lb fertilizer N and the 200 lb manure-N treatments in the third year. The results from the Martin Experiment Station and the two farm sites indicate that the repeated application of approximately 200 lbs N as manure per acre will result in yields equivalent to those from 150 lbs of ammonium nitrate nitrogen.

Water quality monitoring at Martin has indicated that rates of manure nitrogen as high as 225 lbs per acre result in yields comparable to those using recommended rates of inorganic N fertilizers 150 lb/acre) with no significant impact on nitrate-N concentrations in the leachate. Cumulative nitrate-N losses are much higher from plots receiving over 450 lb N per acre per year, and may pose a problem.

Observations at the Dairy Station for the last few years indicate that there is appreciable N being made available from prior manure additions, and leaching losses have occasionally been unacceptable even from 0 N control plots. Again, these data indicate that we will need to closely evaluate the previous history of a farm when deciding how much N or P we will add in any form.

The results of this work will provide for better manure application rate recommendations for the mid-south region. In addition, economic analyses are forthcoming to evaluate what levels of manure application will provide the best level of agronomic, environmental and economic return.

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Sustainable Whole Farm Grain/Silage Production Systems for the Southeast

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Project area
Whole farm systems

Project duration
June1993-May1997

Budget

SARE	$240,639
ACE	
Matching	$218,600

Objectives

1.) Develop profitable alternatives, using white lupin, tropical corn, and hybrid pearl millet to current grain and silage production systems employed by farmers in the Southeast.

2.) Develop sustainable systems utilizing these alternative crops that integrate into diversified (crop/livestock) farming systems and result in reduced pesticide and fertilizer inputs and conservation of soil, water and energy.

3.) Determine the profitability of production systems using these alternative crops as compared to traditional systems currently employed by farmers in the Southeast and disseminate this information to farmers through farm meetings, popular press articles, extension publications, videos and television.

Approach

Coordinated experiments are being conducted at five locations in Alabama, Florida, and Georgia extending from the panhandle of Florida to the northern edge of the Coastal Plain in central Alabama. The core experiment is a cropping systems experiment of six cropping systems in conjunction with four rates of nitrogen (N) fertilizer applied to the summer crops in the systems.

Cropping systems are:

1.) Wheat/soybean
2.) Wheat/tropical corn
3.) Wheat/pearl millet
4.) Lupin/soybean
5.) Lupin/tropical corn
6.) Lupin/pearl millet

Nitrogen treatments on summer crops are 0, 60, 120, and 180 lb N/acre. This brackets recommended N rates for these crops under rainfed conditions.

The changes in amounts of nitrogen in the plant/soil system are being measured from the beginning of the study in 1993 until the end of the study in 1996. This will provide information on N utilization efficiency of the systems and allow inferences to be made as to losses of N to the environment via denitrification, runoff and leaching.

Whole plant samples of lupin, pearl millet, and tropical corn are collected at appropriate growth stages for each crop for silage yield determinations. Silage quality from these crops is determined (measurements of DM, ADF, NDF, IVDMD, CP and Ash). Ensiling evaluation (pH, DM, lactic acid in laboratory minisilos) is made each year. Data collected includes yields and all production inputs and values necessary for accurate economic analyses. Enterprise budgets are being developed to determine the most economically viable cropping system.

In addition to the primary test, separate but coordinated studies include:

1.) Experiments to determine the optimum planting dates for tropical corn and pearl millet;

2.) Animal feed trials to evaluate silage of the three alternative crops—tropical corn, pearl millet, and lupin;

3.) Experiments to determine the effectiveness of the biological insecticide, *Bacillus thuringiensis* Berl., for control of fall armyworm in tropical corn;

4.) Characterization of potential insect pests of pearl millet;

5.) Evaluation and screening of new lupin germplasm;

6.) Evaluation of the potential forage value of new pearl millet hybrids;

7.) Determination of optimum soil pH and phosphorus needs of pearl millet;

8.) The role of phosphorus nutrition in seed quality of white lupin.

Results

The 1996 season results varied due to location and environmental conditions. The record low temperatures of the 1995-96 winter severely impacted lupin plantings. All locations underwent some periods of early season drought stress, but later season rainfall was above normal.

In summary, data indicated that:

1.) Wheat yields were good, ranging from 52 to 70 bu/A. Adequate nitrogen fertilization (120 or 180 lb N/A) applied to previous crops of tropical corn or pearl millet increased wheat grain yield at two of three locations. Residual nitrogen from soybean also tended to increase

yield at one location;

2.) Lupin only survived the severe winter at the southernmost location, in the Florida Panhandle. Lupin silage averaged 3.81 tons (35% DM) and grain yields averaged 18 bu/A at this location. Although crop rotation can greatly improve lupin survival, improvements in germplasm are needed before the crop can be a viable option for growers (other than as a green manure or for use in wildlife plots). Planting date studies have shown the optimum time for planting lupin is four weeks before the first 28 °F freeze. Soil pH had minor effect on lupin yields in a pot study, but adequate phosphorus fertility was important for optimum yields;

3.) Soybean yields were reduced 11percent at two of three locations when double-cropped following lupin vs. wheat;

4.) tropical corn silage ranged from 4.9 to 8.2 tos/A (35% DM) at one location and from 13.6 to 22.4 tons/A at another dependent on previous crop and N fertilizer rate. Grain yields ranged from 46 to 66 bu/A. Tropical corn at the northernmost location has not been harvested yet, due to late planting. At one location, the winter-killed lupin acted as a green manure resulting in tropical corn silage yields of 20.5 tons/A with no nitrogen fertilizer;

5.) Millet silage yields ranged from 7.8 to 21.8 tons/A, dependent on location, N rate and previous crop. At one location, millet yields were maximized (46 bu/A) with 60 lb N/A following lupin. Following wheat, 180 lb N/A was required for maximum yield (54 bu/A). Dependent on location, previous crop, and N rate, millet grain yields ranged from 15 to 72 bu/A. At two locations, 180 lb N/A was required for maximum grain yield, at another yield was maximized with 120 lb N/A.

Forage studies indicate currently available hybrid millet should be used for grain production vs. dual use (forage or grain production). Optimum pH for millet grain production was in the range of 6-6.5. Millet responded to the level of soil test P up to a level that would be "high" according to the Auburn University Soil Testing Laboratory;

6.) All three crops can be ensiled satisfactorily but there is considerable variation in forage analyses between crops and years. Dairy cows on lupin silage based diets had the same milk production as those on temperate corn silage diets while cows on millet and tropical corn diets produced less milk.

Impacts and Potential Contribution

Results suggest that pearl millet may fit into a double-cropping system with current lupin germplasm better than tropical corn due to its shorter growing season. Millet shows promise as an alternative crop for the South that can withstand drought stress well. Variety development is underway that should result in greater disease resistance and increased yields.

As a result in part from this project and satellite projects, there is a tremendous amount of interest in using lupin as a cover crop for cotton production in the Florida panhandle, southern Georgia and Alabama, South Carolina and North Carolina. Resource Seeds (Visalia, California) is also interested in increasing a high alkaloid selection from Tifwhite-78 white lupin seed we sent them at the beginning of the SARE study. A high alkaloid type would be a better choice for a cover crop/green manure in that alkaloids protect the plants from pests and some diseases. Also, there is research to indicate that high alkaloid lupin may suppress certain nematodes.

Based on numerous contacts with the project coordinator from farmers and popular farm press publications, there is an intense interest in lupin, with inquiries from as far as Hawaii and Alaska. We have also furnished information regarding seed sources and markets for lupin growers in Georgia and an organic beef producer who wishes to use lupin as an alternative organically grown protein source. Based on public response to articles on background research for this SARE project, the use of lupin in products for human consumption is an area that should receive further research interest. The public seems to be keenly interested in this topic and a human food market would increase the value of the crop, making it more profitable for farmers to grow. Also, from observations that arose out of our research there is considerable interest in lupin seed to be used for wildlife food plots. This potential is currently being investigated.

Results to date indicate that tropical corn, lupin and pearl millet may be ensiled satisfactorily. The maturity of pearl millet and lupin have affected the nutrient content, but initial data indicate that these crops may be effectively used in a sustainable farming system. Lupin silage may be used in dairy diets based on similar milk production and milk composition to that from temperate corn silage based diets.

Plans for Remainder of Project

The final soil sampling and laboratory analyses for plant and soil nitrogen remain to be done. All data has been turned over to the economist for analysis. We plan to aggressively follow up the intense interest in using lupin as a cover crop/green manure and for wildlife plots by encouraging private seed companies to market currently available commercial varieties (Tifwhite-78 and Lunoble). Research results need to be published and the technology transferred. A lupin production video and management guide is currently being developed. Germplasm improvement for hybrid millet and lupin continues.

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December1996

Evaluation of a Low-input, No-till, No-herbicide Continuous Grazing System for Dairy Cows

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Objectives

1.) Plan an implement a year-round grazing program for dairy cattle using sustainable agriculture techniques; and

2.) Economically evaluate this system compared to the costs of feeding just stored forages.

Approach

This three-year research project is a joint collaboration between Clemson University and Tom Trantham, dairy farmer. It is being conducted on Mr. Trantham's dairy, located 35 miles from campus. Mr. Trantham milks approximately 70 Holstein cows twice per day. A system was designed with the goal of utilizing grazing during as much of the year as possible. Mr. Trantham's dairy consists of 95 acres, 50 of which are available for grazing the milking string. These 50 acres are divided into seven permanent pastures. Movable fence is used to further subdivide each pasture into smaller subplots. The size of the subplots is dependent on the amount of forage available. Sustainable agriculture techniques were utilized including no-till planting, and manure is the main source of fertilizer. Use of herbicides and chemical fertilizers has been minimized. The paddocks are rotationally grazed.

This report includes results from 1994 and 1995. Crops grazed during the winter/spring were mostly cereal grains and ryegrass and crops grazed during the summer were sorghum and millet. A variety of alfalfa designed for grazing was also established. Number of days grazed per paddock per grazing period was minimized so that crop growth did not preclude accurate estimates of dry matter intake based on pre-graze and post-graze clippings. Cows grazed from one to five hours per day, depending on the forage supply. Cows were kept on each paddock for an average of 5.7 days.

Dry matter and nutrients grazed were obtained by collecting 10 pasture samples immediately prior to grazing and immediately after grazing ceased. Samples were taken in a pattern so they were representative of the entire pasture. Each sample was obtained by clipping all forage growth contained within a two-feet by two-feet metal frame that was placed on the ground. Plants were clipped so that approximately two inches of stubble remained. Samples were transported to the laboratory and analyzed for nutrient content.

The advantage of grazing was determined by subtracting the estimated costs for feeding the herd without grazing from the actual costs of the feeding program utilizing grazing.

Results

Cows grazed 437 out of a possible 649 days, which is 69percent of the possible days. They grazed the 1994 spring crop for 74 days, the 1994 summer crop for 86 days, the 1995 winter/spring crop for 119 days, and the summer, 1995 crop for 158 days. Cows consumed an average of 8.9 pounds of dry matter from grazing on the days they grazed. This is approximately 25 percent of their dry matter requirement. This figure varied considerably, depending on the amount of available forage. Cattle that graze consume a higher product than results if that crop is harvested. Cattle naturally choose the lushest, most nutritious parts of the plant and leave the least digestible parts. The average neutral detergent fiber (NDF) of the crop offered averaged 60.1 percent but the portions that the cow ate were only 56.3 percent. This same trend is true for acid detergent fiber (ADF) - ADF of the whole plant offered to the cows was 32.1 percent, but the ADF of the parts of the plant that were consumed was 29.7 percent. This indicates the cows ate the least fibrous portions of the plant. Conversely, the cows ate portions of the plant higher in crude protein (CP) than the whole plant contained, 23.6 percent versus 19.9 percent.

These data illustrate one of the unique advantages of grazing. Had the cows been fed the same crops as harvested feed, they would have been fed a much lower quality product and would have had to expend energy digesting lower quality forage. When all costs associated with grazing were calculated, data to date showed that grazing saved an average of $.34 per cow per day on days when cows grazed. Three of the four seasons reported showed an economic advantage to grazing.

Project area

Livestock system

Project duration

March 1993- Dec. 1997

Budget

SARE	$118,911
ACE	
Matching	$62,700

However, data from the summer of 1995 showed that we had a net loss of seven cents per cow per day. This means that we did not recover the costs of establishing the pasture and this was due to extreme dry weather conditions. Four of the five millet pastures had a negative return and the alfalfa pasture had a positive return of $0.06 per cow per day. Costs savings from grazing varied greatly among pastures and ranged from -$.77/cow/day to $1.20/cow/day. Data to date from this study show that grazing cows instead of feeding harvested feed can result in significant cost savings but bad weather can have negative impacts of the economic advantages of grazing.

Impact of Results

These results will provide guidance to dairy farmers who wish to convert to a farming system that utilizes sustainable agriculture techniques.

Potential Contribution

The results of this project should help farmers to profitably plan their grazing programs based on the successes and failures of this project. It will help them avoid pitfalls that may result in negative returns and assist them in being more profitable.

Plans for Remainder of Project

The data collection phase of this project is complete. We are continuing to analyze and summarize the results of this project and are planning several publications and field days.

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Cover Crop Integration into Conservation Production Systems

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Participants continued on next page

The objectives of this project are to remove barriers to wider use of winter cover crops to build soil productivity, increase farm profitability and reduce adverse environmental impacts of row-crop production.

Objectives

This project will make cover crops more attractive by reducing their cost and developing easier ways of managing them. Specifically, the project seeks to:

1.) Identify legume cover crop germplasm with superior reseeding characteristics.

2.) Demonstrate practical management systems that reduce the need for herbicides in no-till and low-till crop production.

Approach

Cover Crop Nursery Evaluations: Legume cover crop germplasm was screened at several locations representing a range of soil types and climatic zones varying from the gulf coast to northern Tennessee, and from Georgia to western Arkansas. 'Tibbee' crimson clover is used as a standard against which 17 other cover crops are compared seeking a superior combination of winter hardiness, vigor, early maturity and hard seededness. Additionally, seed of one promising new legume cover crop, balansa clover (*Trifolium balansae*), which was identified in this project as possessing superior reseeding potential, was distributed to fifteen farmers who responded to articles in *Common Ground* and *Agriculture Research* magazines for evaluation on acre-sized areas. A follow up survey was sent to these producers to obtain input and most responded and requested that seed be sent again in the fall of 1996.

Seed increase of another promising reseeding, spotted burclover (*Medicago arabica* (L.) Hudson) was slowed due to a combination of dry fall conditions combined with a cold winter and heavy insect feeding. Seed increase of this medic will be continued in cooperation with the USDA-NRCS Jamie Whitten Plant Materials Center in Coffeeville, Mississippi. Detailed observations were made of the growth of spotted burclover in order to relate time after flower blooming to the production of hard seed.

Management System Evaluations: Management systems being evaluated in replicated-plot and on-farm studies include demonstrating mechanical killing cover crops ahead of no-till planting cotton and other crops, testing planter attachments to facilitate the planting of cotton through the cover crop residues, and evaluating the ability of the residue mulches to reduce weed competition with summer crops. A *Mowing Date Study* compared mowing vetch, rye, or rye plus vetch 0, 2, 6, 14, or 26 days ahead of no-till cotton planting in early May and tested four commercial residue management planter attachments. A *Cover Crop X Weed Control Study* compared four winter cover crops (vetch, rye, rye plus vetch, or volunteer vegetation) and four weed control treatments (ranging from no-till with broadcast preemergence and postemergence herbicides to a minimum herbicide treatment involving mechanical and flame cultivation) for cotton production. Soil temperature, cotton growth, and weed populations are measured.

In on-farm evaluations, Steve McKaskle, an organic cotton farmer in Braggadocio, Missouri, planted cotton following a rye/vetch cover crop. He planted three ways: no-till following either flail mowing or rolling with a stalk chopper (the front part of a "do-all"), or after disking in the cover crop.

Final filming was done for the production of a video to help communicate the experiences of this project to a wider audience.

Results

This project has identified two promising new legume cover crops: southern spotted burclover and Paradana balansa clover. Both these cover crops mature seed slightly earlier than crimson clover, although they often do not produce as much biomass. Their big advantage over crimson clover is their ability to reseed for several years from a single seed crop. Both have volunteered back for four years following maturation of a seed crop in 1993 in Senatobia, Mississippi, and they have also reseeded successfully for at least two years was at several other locations in Alabama, Georgia, and Mississippi. Neither Tibbee nor AU Robin crimson clover reseeded for more than one year at any loca-

Project area
Cover crops systems

Project duration
March 1993-Dec. 1998

Budget

SARE	$135,540
ACE	
Matching	$117,040

tion.

Unlike crimson clover, whose flowers open at one time, spotted burclover produces clusters of three to five flowers on successive main stem. Flowers appeared at intervals of 2.5 days during a warm spring (1995) and at three-day intervals during a cold spring (1996). Individual seed weight increases steadily for 40 to 45 days after a flower opens and about 50 percent of seeds become viable and hard after about 30 days in both years. In the absence of insect feeding, maximal hard seed crop was produced by 40 days after first bloom.

Insect pests, the clover leaf weevil (*Hypera punctata* Fabricius) and the alfalfa weevil (*Hypera postica* Gyllenhal), preferentially attack medics over other winter legume cover crops and delay and reduce seed development. Cold and insect damage to the local spotted burclover accession has not been as severe as to the commercial (Australian) annual burclovers. No insect control measures have been taken in any of the tests to date. While insect damage did not eliminate reseeding in these studies, in a commercial seed production enterprise, insect control, possibly using parasitic wasps, would significantly increase seed yield.

Mowing was effective in killing rye and vetch cover crops during late April. Cover crop residues dry rapidly after mow-killing. Use of tined-wheel row cleaners enabled successful no-till cotton planting only two to six days after mow-killing dense cover crops, but row cleaners became wrapped up with vegetation when planting was done the same day as mowing while the residues were still moist and flexible. This was the experience at Steve McKaskle's farm.

Heavy cover crop mulches did not eliminate the need for supplemental chemical and/or mechanical weed control. However, cover crops permitted no-till cotton to be produced using a banded herbicide application comparable to that used in conventional-tillage culture.

Impact and Potential Contribution

These studies demonstrate two ways that farmers can increase their production efficiency and build their soil quality without increasing their production costs. The farmer and society both benefit from decreased runoff and erosion losses and improved water quality.

Reseeding cover crops offer the benefits of increased organic matter inputs to soils and reductions in needs for purchased nitrogen fertilizer without the expense of seeding a cover crop each fall. If the cover crops are planted on time and managed to produce a heavy seed crop the first spring, the farmer could save $25/acre cover crop seeding costs plus $15/acre in fertilizer savings (50 lb/a) for the following three to four years even in crop rotations where cover crops cannot make seed each year.

Alternatively, planting heavy residue-producing cover crops like rye and hairy vetch can offset herbicide costs in no-till systems. These cover crops mature seed too late in the spring to reseed by themselves, so they must be planted each fall. However, they shade out undesireable species and can themselves be killed by mowing or rolling and so can permit no-till planting without the need for burndown herbicides. The resulting mulches assist with weed control so that total herbicides can be restricted to a band over the row at rates no higher than are used with conventional tillage culture. In this system, the farmer can get the soil and water conservation benefits of no-till using cover crops and pay for the cover crop planting costs with savings in herbicide expenses.

Both of these approaches benefit consumers by maintaining a cleaner environment while producing crops with maximum efficiency and minimum cost.

This project will be finalized in the coming year. Final reseeding observations will be collected, farmers participating in balansa clover evaluations will be surveyed, and production of a video tape will be completed.

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LS94-57
Annual Report
December1996

Disease and Insect Management Using New Crop Rotations for Sustainable Production of Row Crops in the Southeastern United States

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Objectives

The objectives of the project are to enhance current row cropping systems in the southeastern U.S. by expanding crop rotations through the incorporation of two new crops which can be sustainable and profitable and which result in reduced damage from diseases and insects. Twelve rotation sequences have been established which incorporate canola and grain pearl millet into the standard annual cropping system of wheat as the fall-planted crop followed by no-till soybeans as the summer crop. By expanding the the number of crops planted over time, we hope to take advantage of the decline of insect pests and disease-causing microorganisms that typically occurs with crop rotation. The data collected will also provide insights into the fluctuations of pest populations and the damage they cause in a variety of cropping sequences over a four year period. Optimum pest management systems for these combinations of crops have not been determined. Results of the study will be communicated by demonstrations, various publications, and an instructional video.

Approach

The 12 annual rotations with wheat, forage rye, or canola (fall-planted) and soybeans or pearl millet (summer-planted) was established for the primary research plots at the University of Georgia Southwest Branch Experiment Station at Plains. Demonstration plots were located on a farm near Plains and at the Sunbelt Expo site near Moultrie, GA.

Results

A one-year rotation of canola reduced the severity of take-all root rot on wheat. Grain yield was the same as for grain harvested from plots with no take-all. Wheat seedlings grown in soil from field plots of the 12 rotations exhibited a similar reduction in disease severity when the preceding winter crop was canola. Some reduction in take-all damage was found when pearl millet was grown as the summer crop in place of soybeans, but these results need further investigation during the third year of the study

Several severe winter freezes during the 1995-96 season killed canola. More winter hardy cultivars are neeeded for this new crop. As a result, no data on diseases or insect damage to canola could be determined. The number of seedlings of soybeans and pearl millet was reduced when planted after canola but not after rye or wheat. Soybean yield was reduced. This may be due to release of toxic substances from decaying canola roots. If these observations are confirmed in the 1997 season, it may be necessary to increase seeding rates of these crops after canola. After two years, none of the rotation sequences which incorporates canola and pearl millet have affected severity of stem canker on soybeans.

The infestation of Hessian fly larvae which feed on young wheat stems was lower following rotation with canola. Spring infestations of the insect were not affected by the previous crop. False chinch bugs, which feed on seedlings of various crops, were present during the first year of the study. During the second season, false chinch bugs killed some of the emerging pearl millet seedlings following canola. The insect pests fall armyworm, southern green stink bug, and leaffooted bug were found on the developing seed of pearl millet, but their populations were not influenced by rotation. The winter crop that preceded soybeans did not affect the population of any insect pest on the crop. Soybean loopers and velvetbean caterpillars caused some of damage to soybeans.

In 1996, grain yield of pearl millet was not consistently affected by the preceding winter crop. High stand density was correlated with increased severity of leaf blight and stalk rot, and variation within stand density may have obscured effects due to crop rotation.

Impact of Results

The results to date show that canola may reduce the stand of following summer crops and it may support an increase in the population of false chinch bugs which feed on seedlings of pearl millet. No other detrimental effects from inclusion of canola and pearl millet into rotations with wheat, rye for winter forage, and soybeans have been observed. Rotation with canola significantly reduces damage from take-all root

Project area

Integrated Management

Project duration

March 1994-Dec. 1997

Budget

SARE	$152,200
ACE	
Matching	$52,614

rot on a following crop of wheat. All results need to be confirmed from another year of testing. The impact of the results is that canola and pearl millet can be used in a variety of crop rotation sequences with other row crops with several beneficial or benign effects. Some detrimental effects of canola need further investigation for their economic impact on crop production costs.

Plans for Remainder of Project

Plans for the remainder of the project include validation of results from the second year of the study. Information on disease and insect damage to canola will be determined in the third year of the study. As conclusions are validated, they will be incorporated into the training video and educational materials that are developed. An in-depth economic analysis will be made spanning the three years of the study to get a complete evaluation of the feasibility of the crop management scheme.

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Annual Report
December1996

Post-CRP Land Management and Sustainable Production Alternatives for Highly Erodible Lands in the Southern Great Plains

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The majority of the contracts of 1.2 million acres of Conservation Reserve Program (CRP) lands in Oklahoma will expire in 1996, 1997, and 1998. Contract holders will have to choose a future use for their CRP lands. The Freedom to Farm legislation and pending regulations for a new program will impact landowners' decision and the future use of highly erodible lands (HEL) across the Great Plains. About 39 percent of the enrolled acres may not meet the minimum erosion index or environmental benefit requirements of the proposed program. Landowners will have to decide whether to use CRP grasslands in livestock production or to revert to annual crop production. They will choose either to remove or not remove the accumulated litter, plow under the sod or no-till the first crop into killed grass. The effects of integrated management technologies for HEL on the long-term productivity of the land resource and their impact on water quality are not fully understood, particularly at the field or watershed level. The deficiency must be addressed to prevent resource degradation that is likely to recur once these HEL are returned to crop or forage production.

Objectives

1.) Develop best-management plans to prepare CRP grasslands for grazing or haying,

2.) Determine the productivity and profitability of land management systems to revert successfully and environmentally sound to winter wheat and cotton production on highly-erodible lands in the Southern Plains.

Approach

Under USDA-ARS coordination, a three-year collaborative project was conducted on two CRP fields under contract since 1987 and 1989 to develop sustainable post-contract options for CRP lands. This report highlights the 1995-96 research results and outreach activities during the second year of the project. Field-scale research and demonstration plots were reestablished in a new section of the fields. Treatments included a minimum-input approach to managing an Old World bluestem (OWB) stand, optimal OWB management practices, conservation-tillage (CT) wheat (sweep or disk to kill the sod), no-tillage (NT) wheat into killed sod, and, at the SW site, row-till cotton. Active involvement of the Natural Resource Conservation Service (NRCS) and Cooperative Extension Service (ES) field offices was sustained during the conduct of the field research. Assistance of local agricultural businesses and producers in performing selected field operations were actively pursued to facilitate the technology transfer during such interactions with varying degree of success. Outreach efforts included field days at each location in 1996. A technical conference and producers' meetings were also conducted during the year to deliver project recommendations to producers, local, state and federal action agency personnel, soil and water industry professionals, regulators, and the general public.

We collected data on grass and crop growth and yield, soil and weather conditions during the growing season and non-cropped periods. A journal of field supplies, operations, equipment, and time was kept to derive an economic analysis of each land use option.

Results

The 1994-96 data showed that management actions are needed on CRP fields at the end of the contract period to convert these fields into productive grasslands. Greatest limitations are low nutrient levels, particularly nitrogen and phosphorus, forage quality, and concealed sparse stand. The overgrowth smothered and impeded development of new tillers. It prevented new seedlings from establishing in bare soil between existing crowns. The large accumulation of old dry matter also lowered the quality of the hay. Plant nutrient applications and weed control must be made to improve density and quality of the stand and optimize forage production. In 1995, an application of 67 kg N and 22 kg P/ha resulted in no significant increase in forage production at Forgan and a 2.9-fold increase at Duke. In 1996, OWB forage production increased an average 1.7-fold by improved management and fertilizers at both locations.

In nutrient-depleted CRP lands, N and P fertilizers must be applied to convert these HEL into productive croplands, regardless of tillage methods. At Forgan, late tillage and suppres-

Project area
Management system

Project duration
March 1994-Dec. 1997

Budget:
SARE $196,100
ACE
Matching $152,400

sion of OWB depleted stored soil water of CT plots in 1994. Higher profile moisture in NT plots resulted in a better stand, forage accumulation and grain yield than in CT plots, except for a first-year wheat crop at Forgan in 1995. At Duke, early chemical suppression of OWB helped emergence and growth of wheat. The crop grew better under the high residue NT system. CT and NT wheat yields averaged 1520 and 1650 kg/ha (24.1 and 26.3 bu/acre), respectively. In an extremely dry 1995, crop yields were low, regardless of soil management methods at both locations. Wheat yields ranged from 190 to 880 kg/ha (3 to 14 bu/acre).

NT wheat was significantly better during the drought of 1995. The crop was produced mainly from stored water as no significant rains fell between October 1995 and June 1996. In 1995, dryland cotton yields averaged 90 lb/acre as poor weather conditions existed at planting and during boll-setting stage. A 1996 crop was not planted due to the extremely dry conditions that prevailed at the site and throughout the region. Variability in weather conditions served as a constant reminder of the precarious environment and the high risk of agricultural production in the Great Plains.

Outreach activities in 1995-96 included field days at both study sites. The Duke tour was held on April 4, 1996, and the Forgan tour on April 11, 1996, to highlight crop growth under drought conditions and last year's research results. From September 30 to October 10, a team of extension specialists from Colorado, Kansas, New Mexico, Oklahoma, and Texas conducted a series of day-long producers' meetings to update CRP contract holders on proposed regulations, and offered suggestions on future land uses based on economic decisions. Meetings were held at seven locations in the five-state area and were well attended.

A major technical CRP conference was organized in Amarillo, Texas, to elaborate on research results and post-contract management options. The Conference message was targeted to NRCS and ES personnel in the Central and Southern Great Plains. The participants came from a wide range of institutional organizations from these states and Washington, DC. Of the 150 attendees, there were farmers (11 percent), representatives from chemical and fertilizer industries (7 percent), Parks and Wildlife departments (7 percent), University (9 percent), private research foundations (2 percent), USDA-FSA (5 percent), USDA-NRCS (45 percent), and USDA-ARS (15 percent). Other outreach efforts were made to prepare publications and news articles for regional and national farm press.

Impact of Results

The CRP has curtailed the degradation of 1.2 million of former OK croplands and more than 36.5 million acres of marginal lands across the United States. The benefits of conservation practices and of research and educational efforts derived from adjoining contrasts of forage-livestock production and sustainable cropping systems reach out to a broad geographic and demographic audience. The success of the approach was attested by the interest in our outreach activities during 1996.

Our research results showed that early spring suppression of the grass conserves stored water that is vital to the production of a cool-season crop in the Great Plains. That saves a full year of production. The need to move back the time line that CRP landowner or operator is permitted to work on the grass cover without financial hardship exists, provided that soil erosion controls are in place. The results also showed that management action is needed at the end of the CRP contract to convert CRP grasslands into productive lands, regardless of future land use. Landowners or operators should be advised of the risks of the neglected conditions and nutrient depletion that currently exist on CRP lands.

Potential Contribution

The project results contributed to the development of sustainable systems and outreach efforts to help end-users determine their best course of action after the CRP. Best-management plans have been developed to prepare CRP grasslands for grazing or haying. We have demonstrated the field-scale productivity of land management systems for reverting back to winter wheat and cotton production on highly-erodible lands. These systems allow an operator to farm HEL in an environmentally sound manner in the Southern Great Plains. Management guidelines for HEL are suggested for conservation policy and regulation development by land resource managers, regulators, and legislators.

Plans for Remainder of Project

Among the remaining tasks for 1997 are efforts to assess production system performance and stability from third-year crops due to extremely dry conditions of 1996 spring and summer, and to develop economic analyses for the land-use options. Rainfall simulation experiments and analysis are planned to evaluate relative soil/environmental benefits of these alternative land-uses.

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LS94-60
LS95-60.1
Annual Report
December1996

Animal Waste, Winter Cover Crops and Biological Antagonists for Sustained Management of Columbia Lance and Other Nematodes on Cotton

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Plant-parasitic nematodes are limiting factors in cotton and other crop-production systems in the southern United States. These parasites restrict root growth and development, resulting in a general stunting of the plant. Poor root development prevents the plant from adequately interfacing with the soil for mineral nutrition and moisture. In addition to losses in cotton yield, the inability of the plant to utilize available nutrients and moisture can result in these nutrients and/or pesticides moving into ground or surface waters and thus becoming pollutants.

Demands for poultry and pork have resulted in rapid expansion of these animal husbandry operations in the southeast, and North Carolina in particular. Modern techniques in animal production result in the accumulation of large quantities of animal waste materials in small areas in rural communities. These animal-waste products are of major concern as sources of surface and ground-water pollution. Poultry litter contains relatively high levels of nitrogen, phosphorus, and potassium. Phosphorus and nitrogen are the most important components in pollution of streams and rivers. The use of high-nutrient manures rather than chemical fertilizers is an environmentally sound method of supplying necessary nutrients to cotton while disposing of this waste product. The ammonia in animal wastes, such as poultry litter, generally acts like slow-release fertilizers and can thus inhibit nematodes while supplying the plant with nitrogen in a safe manner. Another benefit of these organic type of fertilizers is that they increase beneficial microbial activity in soils which may aid in achieving a healthier, better balanced soil environment.

A common practice in southern row-crop agriculture is the sowing of a winter cover crop to prevent soil erosion. A winter rye crop in particular is beneficial in that it suppresses the population levels of many parasitic nematodes. The influence of other winter cover crops, such as vetch, canola, and other small grains on various plant-parasitic nematodes is poorly understood. The use of winter crops also is valuable in protecting the environment since they can scavenge nutrients left from the previous crop, prevent these nutrients from moving off site, improve soil tilth, and are an important component in conservation tillage.

Addition of animal waste products to the soil and the use of winter cover crops that are commonly grown to prevent soil erosion are generally beneficial because they increase the organic matter content of the soil. This is especially important in southern soils since they tend to be low in organic matter. Increasing the level of organic material in these soils improves their nutrient- and moisture-retention properties. Enhanced microbial activity, a result of the application of animal waste products and/or winter cover crops, can provide for an environment where antagonists of plant-parasitic nematodes, especially certain fungi, can aid in suppressing these pests. The use of poultry litter to manage nematode pests of cotton and promote soil health provides a method of biorational pest control that can also reduce the rates of application of chemical pesticides and fertilizers while converting a waste product into a useful material. All of the aforementioned factors serve to enhance sustainability of agricultural production by providing for an improved agroecosystem. Potential reductions in costly farm inputs used can reduce reliance on petroleum based products for pest control and/or chemical fertilizer. Reduced reliance on these products also protects water and air quality.

Objectives

1.) Evaluate the effects of the rate of poultry manure and litter and municipal-waste compost singly and in combination with winter-cover crops and selected nematode antagonists for control of plant parasitic nematodes on cotton.

2.) Determine the potential advantages of organic sources of nitrogen versus standard fertilizers on nitrogen use efficiency and potential environmental impacts.

3.) Incorporate findings into a sustainable cotton- and associated crop-production systems through a series of farmer-managed demonstration tests, tours, cotton production meetings and extension publications.

Approach

Project area
Biological pest control

Project duration
March.1994-Dec.1997

Budget:

SARE	$ 143,412
ACE	
Matching	$196,650

A combination of greenhouse, microplot, and field research plots were used to evaluate a winter rye cover crop with or without poultry litter and fungi for management of root-knot, sting, Columbia lance, stubby-root and reniform nematodes in cotton. All experiments were replicated to permit statistical analysis of the results. Seven field research experiments, five in growers' fields and two on experiment stations, were used as field laboratories. The field plots also served an educational function in that they were featured in research tours for farmers. Greenhouse and small plot tests were conducted in order to more precisely quantify the effects of selected nematode antagonists on these biological systems. This information has been and will continue to be disseminated to extension personnel, farmers and the general public.

Over 2000 soil samples were collected to measure the impact of various treatments on communities of plant-parasitic nematodes. Nutrient levels of both soil from test sites as well as poultry litter were processed to assess the effects of these variables on the agroecosystems studied. Other measurements included cotton yield, numbers of nonparasitic potentially beneficial nematodes at one site, activity of biocontrol agents, and assessments of the cover crops.

Results

Field experiments have clearly demonstrated the benefits of application of poultry litter for management of plant-parasitic nematodes in cotton. Poultry litter has been highly efficacious in suppressing population densities of root-knot, Columbia lance, stubby-root, sting, and lesion nematodes in field soils and in other experimental systems. The inclusion of fungi that parasitize these nematodes was only marginally effective in suppressing numbers of these plant-pathogens. A rye cover crop was effective in suppressing Columbia lance nematode in one field experiment, especially when incorporated in late spring or left on the soil surface in a no-till system. Incorporation of a rye cover crop tended to suppress other plant-parasitic nematodes such as root-knot, reniform and stubby root nematodes in greenhouse and microplot tests.

Impact of Results

Cotton growers in the southern region are increasingly innovative and receptive to implementing new and or developing technologies. The application of animal manures is especially attractive since it can reduce or eliminate the need for expensive commercial fertilizers. Similarly, many farmers are utilizing cover crops, and this practice will be adopted with increasing frequency as they learn that a cover crop can alleviate stress on cotton due to nematode problems. The use of cover crops to improve overall nematode management is especially appropriate, since interest in conservation tillage is increasing. Cover crops cannot only contribute to nematode management, but may aid in preventing off-site movement of nutrients and minimize inputs of soil applied herbicides. This project thus serves to illustrate to growers the benefits of sustainable approaches to cotton production.

Potential Contribution

The use of poultry litter to manage nematode pests of cotton and promote soil health provides a method of biorational pest control that can also reduce the rates of application of chemical pesticides and fertilizers while converting a waste product into a useful material. Thus, the proper selection and management of winter cover crops and animal waste can enhance pest management programs; scavenge surplus nutrients that would otherwise move into ground and surface waters; improve soils health and tilth; improve moisture retention in porous soils; and prevent erosion of top soils.

All of the aforementioned factors can enhance sustainability of agricultural production by providing for a better and healthier agroecosystem. Potential reductions in costly inputs used by farmers can reduce their reliance on petroleum based products for pest control and/or energy-intensive fertilizer products. Reduced reliance on these products also serves to protect water and air quality, thus improving the environment.

Plans for Remainder of Project

Experiments will continue to quantify the effects of litter application on plant-parasitic nematodes and cotton production. Additional emphasis will be placed on evaluating different cover crops, other waste products, and additional nematode-biocontrol agents for enhancing nematode control. Further research will involve the characterization of plant-decomposition compounds responsible for associated nematode control. More resources will be devoted to outreach and extension efforts to disseminate this information.

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Sustainable Agriculture Research and Education
Southern Region

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December1996

Integrating Sustainable Forestry into the Whole Farm Management of Minority and Limited Resource Landowners in Two Regions of Arkansas

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The project compares community-based participatory strategies to encourage limited resource and minority farmers to integrate sustainable woodland management into their whole farm system. Woodlands (predominantly hardwoods) are a potentially important source of farm income for landowners in the Delta and the Ozark Foothills regions of Arkansas. In these areas limited resource and minority farmers historically do not participate in traditional outreach programs such as management planning by the Arkansas Forestry Commission, training by Cooperative Extension, the Conservation Reserve Program and the Wetlands Reserve Program.

These farmer-owned woodlands, typically areas marginal for farming (wet areas or steep slopes), are treated as "savings accounts" with the only "management" being a "high-grade" harvest when the owner needs extra cash. Due to low volume, low quality and lack of knowledge as to true values, the owners often receive only a small portion of the true economic value of the woodlands when they do sell timber.

Objectives

1.) Test context-appropriate participatory strategies to promote sustainable farm forestry for the Delta and Ozarks.

2.) Compare context and strategies to identify factors that influence effectiveness.

3.) Engage limited resource and minority farmers, community based organizations, technical advisors and policy makers in a dialogue about how best to effectively promote sustainable management of hardwoods on the farm.

4.) Evaluate existing policies and programs, and recommend improved policies and programs.

Approach

The objectives are being met by various means of promoting sustainable hardwood forest management practices, the establishment of two forest landowner associations, demonstrating and assessing land-use options and sharing results.

Participants are collaborating in the collection and development of fact sheets on sustainable farm forestry which are designed to reach educationally disadvantaged farmers. These fact sheets are being assembled into localized handbooks targeted to the unique needs of the two project areas. Forest management workshops, a demonstration forest and non-timber, income-generating enterprises are all part of the project activities.

Results

To date, there have been five coordination meetings of collaborating agency representatives; four focus group meetings with landowners; six forest management workshops with landowners, to which a total of over 350 landowners have attended; establishment of two forest landowner associations with combined membership exceeding 150; completion of the development of the demonstration forest, including development of several non-timber income-generating technologies.

Impact of Results

While it has not been possible to measure the collective impacts of these activities at the landscape level, there have been substantial increases in the requests for informational materials and technical assistance from state and federal forestry agencies in the project areas. Technical assistance/extension staff have reported increased understanding and appreciation on the part of relatively small woodland owners of the benefits of managing their forest resources on a sustained basis.

Potential Contribution

Increases in the levels of sustained forest management practices will have both economic and environmental benefits in the target regions. Economic benefits will initially accrue to individual landowners, but will ultimately accrue to the rural communities through the continued supply of hardwood resources available to the local forest products industries. Environmental benefits include reduced soil erosion and enhanced flood control through the conversion of bottomlands previously used for agricultural crop production but converted into woodlands; reduced nonpoint source pollution through the use of forested filter strips and streambank stabilization practices; and improved wildlife habitats.

Project area
Integrated systems

Project duration
April 1994-Dec. 1997

Budget:

SARE	$246,710
ACE	
Matching	$159,086

Plans for Remainder of Project

Future plans include completing the development and dissemination of forest management fact sheets; completing the comparative analyses and preparing the final report.

The ALFDC has been active in the demonstration part of the project in 1996. Establishment of the distinct management procedures and forest types was completed by marking out the demonstration forest. This allows us to develop a strategic plan for managing the forest based on the species of trees growing there. In order to promote self-sustainability and the identification of woodland landowners, we must demonstrate the commercial value of their species of trees by hosting demonstrations on our Fargo Site.

The Woodland Land Owners Association is in the planning stage, with the Paraprofessional Woodland identified.

The Shiitake mushroom demonstration is now off to a running start with 215 logs having been inoculated this past winter. The total number of Shiitake Logs at ALFDC is now 265. In the next three months we will inoculate another 800 logs. At this point our demonstration will be moved to our Moro, Arkansas, satellite facility, and we will utilize an old gymnasium to demonstrate year round mushroom cultivation.

The forest trash removal effort has gone well. We have removed 90 cubic yards of trash so far and all that is left is broken glass bottles and small tin cans.

In the Ozark Foothills, this project has developed a Woodland Landowners Association in Independence County to assist with management and marketing activities. The Ozark Woodland Owners Association is now finishing its second year in existence. Listed below are some of the activities and accomplishments in 1996.

A field day was held at the Charles Osborne farm near Cord, Arkansas. Twenty six people attended the field day, which was on pine management and thinning of hardwood stands. There was excellent information presented. Three newsletters were sent out to members of the association. The association has offered free consultant services to members of the association to make an evaluation of their forest land. The association has developed a plan of work for 1997. The association has also made the consultant service available to any landowner in Independence County.

Planning has begun on the formation of two other landowner associations. One is in Izard county and the other is a joint association for Cleburne and Van Buren Counties.

In the process of working with these groups to promote forest management, Ozark Foothills RC&D Council and Winrock International were able to work with NRCS and eight conservation districts in central Arkansas to develop a forestry improvement EQIP priority area. NRCS has requested $200,000 for FY 97 to go to these eight counties to promote forest improvement on private forest land. The counties are: Cleburne, Van Buren, Searcy, Newton Faulkner, Perry, Conway, and Pope. The EQIP program is a USDA cost-share program to help landowners implement approved best management practices on private owned land.

There are also efforts underway by several organizations, including Ozark Foothills RC&D Council, to develop a landowner education project to go along with the EQIP program. The landowner education would focus on helping landowners improve their forest land for sustainable production of wood products and wildlife habitat.

During the last two years Ozark Foothills RC&D Council has come to the conclusion that the use of private forest consultants by landowners will benefit the forest resources in this region. Therefore, in all future efforts the council will try to promote to landowners the use of these consultants.

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Intercropping Small Grains and Lupin for Sustainable On-Farm Utilization

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This project is concerned with developing alternative sources of high-quality feed for the dairy farmers of the Southeast. The researchers are developing and testing binary mixtures of lupin, a new kind of grain legume and small grains, such as wheat and oat. First-year results from both on-farm and research station experiments indicate that 25 tons/acre of 65 percent moisture silage of excellent quality can be produced during a six-month growing season.

Intercropping, growing two crops on the same land at the same time, is an age old practice that has all but disappeared from modern American agriculture. It is still widely practiced in the tropics where yield stability and diversity are more important than maximum yield per unit area. Other advantages are a reduction in disease incidence and insect pests. Plant viruses, transmitted by insects, are also often less serious in mixed stands compared to pure stands.

Dairy farmers in the southeastern United States are at a disadvantage compared to their colleagues in other parts of the country. They have to work harder to generate the base feed for their dairy herd. Alfalfa and corn silage are the basic staples of dairying in most of the country. Because of the large management input required, it is not very economical to grow alfalfa in the Southeast. Yields for corn silage are also lower than in other parts of the country. The South, however, has one advantage over most other regions. It has a virtually 12-month growing season with the ability to grow cool season crops during the fall-winter-spring season. Traditional winter crops have been small grains for grain, grazing or silage.

Silage is often the desired form to feed forages to dairy cattle because (1) field losses are less, (2) harvesting is not affected as much by weather as is haying, (3) silage involves less labor in feeding on most farms, (4) silage is much easier than hay to use in "total mixed rations," a method used on the majority of today's dairies, and (5) ensiling crops often blend into double cropping more readily than other methods of harvesting.

Therefore, use of silage helps the Southeastern dairy producer in managing feed quality, land/crop management, ease of feeding and, if used properly, profitability/sustainability. Wheat silage is considered a very good winter crop for the Southeast, but does not possess some of the feeding or agronomic advantages of legumes.

Four on-farm and research station experiments were conducted to develop and test binary mixtures of small grain and lupin. White lupin is a winter grown annual legume adapted to well-drained, low-fertility, coarse-textured, neutral to acidic soils, such as those in the Southern Coastal Plain. Lupin possess some of the advantages mentioned in the previous paragraph, but information on lupin silage is limited. Based upon data available, lupin silage is palatable if harvested at the proper maturity, although energy content may be relatively low due to fibrous parts of the plants, such as stalks. Binary mixtures of wheat and lupin may provide the advantage of yield increases, as well as maintaining a smaller stalk of lupin and, therefore, reducing fiber content of the lupin. In addition, wheat-lupin mixtures could allow the wilting of the crop to improve ensiling properties without a major loss of leaf, which occurs when lupin alone is wilted. Therefore, silage binary mixtures could have several advantages over either crop alone.

Objectives

The objective of the research station experiment is to establish a practical range of seeding rates and small grain to lupin ratios. To accomplish this, one wheat and two lupin cultivars at six seeding rates in pure stands were established. Three wheat seeding rates were then tested in mixture with four seeding rates for each of two distinct lupin cultivars for a total of 24 intercropped stands. In 1995, researchers harvested a portion of each plot six times, beginning at flowering. They measured yield and forage quality characteristics at each harvest date. Maximum biomass was achieved at full bloom for lupin. This is good news because quality declines with advancing maturity. On the average in 1995, this trial yielded 25 tons of silage (65 percent moisture) per acre in a six months growing season.

Approach

Two on-farm trials tested a smaller range of

Project area
Cropping systems

Project duration
March 1994-Dec. 1997

Budget:

SARE	$143,151
ACE Matching	$164,759

small grain lupin combinations under actual production conditions. Regular farm implements were used to prepare the field and put the seed into the ground. For a yield estimate, a small area from each plot was harvested with a three-foot sickle bar mower. On-farm trial results emphasize the impact of nature on agricultural experiments. In 1995, participants weren't able to plant at the ideal time in Virginia because it was too dry. Late planting and competition from chickweed, a common winter weed in the South, resulted in a very poor stand. A severe rust epidemic at the Alabama location reduced oat yields substantially, compared to expected yields. Nevertheless, the average silage yield (65 percent moisture) at the Alabama location was 11 tons per acre. Given the problems that the crop encountered, it was still considered a respectable showing.

The third on-farm trial was a demonstration of the usefulness of white lupin as a winter cover or green manure crop. The location was the Black Marsh Farm in Virginia's Rappahannock River Valley. A 12-acre field was seeded to white lupin in October 1994. In late spring 1995, technicians measured dry matter yield and calculated nitrogen concentration. Lupin contributed about 110 lbs of nitrogen per acre to the crop following it, sweetcorn. Altogether the 1995 results indicated that high quality silage can be produced during the fall and winter to be used in base rations on dairy farms.

1996 results

We demonstrated last year that over 15 tons of silage (65 percent moisture) can be produced per acre. This year's work shows that this silage has very high quality. Three out of four forage yield components exceeded a relative feed value of 120; the lupin leaf component had an RFV of 239. The resulting total silage has an RFV exceeding 130, which is in the range found for corn silage made from corn with well developed ears. Growing a small grain with the lupin rather than lupin in monoculture produces some desirable effects, among them enhanced survival of lupin seedling. The research also shows that careful seedbed preparation is a must for successful lupin cultivation. Fall-seeded lupin is a very attractive deer browse in wildlife plots. Deer tended to consume lupin preferentially over all other forages offered to them.

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Cooperators continued on next page

Project area
Integrated systems

Project duration
March 1994-Dec. 1997

Budget:
SARE $180,497
ACE
Matching $127,924

The primary location of the project is at NCSU's Dairy Educational Unit on Lake Wheeler Road in Raleigh, North Carolina, along with a demonstration site at North Carolina A&T State University. During 1994 and early 1995, about 77 acres of cropland adjacent to NCSU's dairy educational unit were allocated to 38 paddocks with lanes, fencing, and water lines installed. Paddocks were seeded to various pasture species to allow for growth of pastures in both cool and warm seasons. Warm season perennial grasses are overseeded with winter annuals to provide additional grazing in winter. Surplus forage from paddocks is harvested as hay or haylage in large round bales and stored until needed. Housing for confinement cows is provided in a free-stall barn with adjacent exercise lots. Forage storage is in trench and upright silos for corn silage and haylage harvested nearby. Cows in confinement groups are fed total mixed rations including mixtures of corn silage, haylage, and grain. All cows are milked in a double-six herring-bone milking parlor with electronic recording of milk weights.

A pasture-based system has been installed on a smaller scale for the grazing demonstration at NCA&TSU. About 25 cows are milked in a flat barn. Corn silage is available when pasture is limiting.

Objectives

1.) Compare and evaluate profitability of two integrated systems of dairy production; one based on intensively managed pasture crops, the other based on row crops and conventional confinement housing and feeding.

2.) Evaluate the impact of the pasture-based system on animal performance and health compared to conventional confinement system.

3.) Examine the feasibility of seasonal milk production within pasture-based and conventional confinement systems.

4.) Evaluate nonpoint source water quality and soil conservation impacts on land uses under the pasture-based and row-crop forage systems.

5.) Demonstrate and disseminate the results among farmers, extension personnel, service industry personnel, students, and others.

Progress on Objectives 1, 2, and 3.

Since March 1995, we have completed two lactations of spring-calving cows on pasture and confinement systems and are well into the second lactation for fall-calving groups. Each season (fall and spring), 36 cows are assigned to the grazing system and 36 are assigned to the confinement system. We started with more Holsteins than Jerseys in each treatment the first year but have included approximately equal numbers of Jersey and Holsteins in subsequent replicates. At the end of a lactation (about 280 to 320 days) all cows that remained healthy and rebred within a 75-day period were reassigned to their respective treatment groups. Cull cows and cows that died were replaced with young cows due to calve at the appropriate time. There were differences in milk production and in daily feed costs between the two systems. The confinement groups produced 6.3 percent to 25 percent more milk per cow per day through each season but feed costs were also higher for confinement cows.Therefore, income over feed cost has been similar between the two systems.

Across all lactation replicates to date, incidence of mastitis has been nearly twice as great among confinement cows than among cows using pasture (80 versus 42 cases). Six confinement cows have been culled and another died because of mastitis while this was not a problem among grazing cows. During the first grazing season, several pastured cows (Holsteins) had sore feet from walking on gravel in lanes and one cow died from bloat when grazing alfalfa.

Lameness and bloat have not been a problem in subsequent replicates. Both groups have had lower pregnancy rates than desired in 75-day breeding seasons but more observations are needed to effectively evaluate reproductive performance.

At NCA&T, an 18 percent increase in production was observed during the grazing season (April to October) in 1996 compared to 1995 as the farm workers became more familiar with managing the grazing paddocks. Feed costs were also lower during 1996 while body condition of the cows has improved. Manure handling chores

were decreased by about 50 percent because of the additional time cows were on pasture. Because of sharp gravel on some of the lanes a few cows had some lameness. Reproduction continues to be a challenge in that small herd because the cows are not yet bred in one season.

Progress on Objective 4: Three portable water samplers equipped with flow meters were used to collect storm event runoff samples. The three sites included one located where water drained from a very dense permanent pasture area (R1); one sampling runoff from a bare exercise lot for confinement cows (R2); and one sampling runoff from a vegetative area with more slope and greater cow usage at calving and at the end of lactation (R3). Samplers have been in place since June, (R1) or September, (R2 and R3) 1995. The pH for all sampling events for each of the three sites were between the acceptable ranges of 6.0 to 9.0 as specified in the water quality standards. Summarized below are runoff data for other variables current to October 1996 for the three locations.

Site R1: Generally, overall total Kjeldahl nitrogen (TKN), ammonia (NH3), and nitrate (NO3) leaving this site were low in both 1995 and 1996 although NO3 was elevated in one sample during a three-inch rain that followed an extended hot, dry period. Other analyses including total phosphorous (TP), ortho phosphorous (O-PO4-P), chloride (CL), carbon-oxygen demand (COD), total solids (TS), filterable suspended solids (FSS), and conductivity (COND) also averaged relatively low from the pasture. This indicates that the densely vegetated, rotationally grazed pasture is effectively retaining manure, urine, and soil in the field instead of allowing it to leave via runoff during storm events.

Site R2: In contrast to pasture runoff, average TKN and NH3 were many times greater off the bare exercise lot in both years. This was also true of both measures of phosphorous, as well as chloride, COD, TS, FSS, and COND.

Only nitrate was at relatively low levels, probably because rapid runoff prevented conversion to nitrate. For example, total nitrogen leaving this site averaged 16 to 41 times greater than that leaving the pasture.

We have addressed these issues with installation of a settling basin to remove much of the sediment and nutrients. Also, we plan to install a system to allow further processing of runoff across vegetative filter strips before it reaches a stream.

Site R3: In 1995 and 1996, most measures of nutrient runoff were only slightly greater than from other pasture site (R1). Most values were within limits set by NC's Division of Water Quality. One concern at this location was the amount of solids leaving the site. Although much lower than from the bare exercise lot, total solids and filterable suspended solids were 2.5 to 20 times concentrations leaving the pasture area. This may be because the ground cover at this site was not as lush as at Site R1 and the contributing slope is greater.

Progress on Objective 5: The project includes a diverse advisory group with members from Virginia and South Carolina as well as North Carolina. Advisory meetings were held in May 1994, March 1995, and November 1996. Our intent is to provide outreach through several cooperating dairy farms in all three states. Results from our study will also be included in dairy educational meetings, grazing management schools and facilitated pasture walks planned for the region. Outreach activities have included support of a dairy grazing field day in July 1994 in Virginia, hosting a field day in November 1995 at NCSU, conducting a dairy grazing school in June 1996, hosting a watershed educational tour in October 1996, and participating in the 11th Annual Sustainable Agriculture Conference in Rock Hill, South Carolina in November 1996.

The grazing management school included instructors from NCSU, Virginia Tech, NRCS, and industry with participants from both North Carolina and Virginia including NCSU and NCA&T dairy farm workers. Two of our advisory team members, Tom Trantham in South Carolina and Bill Patterson in Virginia hosted tours in November 1996, associated with Sustainable Agriculture Conferences. Another advisory committee member, David Iles of North Carolina hosted a pasture walk/field day in August, 1996 with graziers present from three states.

Plans for Remainder of Project

Evaluation of relative profitability of pasture and confinement systems will require use of actual data on production, feed costs, reproduction, and health problems over several replicates. In addition, computer simulation using various herd sizes, labor needs, land resources, and equipment/facility assumptions will be needed to evaluate overall economic potential of the two systems. Environmental factors and associated costs also need to be considered in the overall evaluation. Less potential for erosion, nutrient runoff, and less need to store and handle manure and waste water in a grazing system should offset some differences in milk production per cow.

Plans have been initiated to host a regional dairy grazing field day in June 1997 and also to conduct two dairy grazing management schools in 1997. We were able to use the concepts from our SARE project to secure funding from the North Carolina legislature to convert a North Carolina Department of Agriculture herd into a grazing-based dairy at the Center for Environmental Farming Systems in Goldsboro, North Carolina. The plans for that new facility have been completed and construction will begin in 1997. This new facility will allow us to examine grazing in an empirical whole-farm system.

Results from studies associated with our current project will provide information needed for producers to effectively incorporate environmentally sound and economical practices into their dairy farm businesses. If successful sustainable practices can be documented for this region, the long-term competitiveness of dairying in the southeastern United States should be enhanced. This will result in a more stable local agricultural community and continued availability of fresh milk at reasonable prices for local consumers.

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Wildlife Enhancement and Education as a Catalyst in the Widespread Implementation of Sustainable Agricultural Practices

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Project area
Integrated management

Project duration
March 1995-Dec.1998

Budget:

SARE	$98, 205
ACE	$75, 000
Matching	$202, 904

Objectives

This project explores the feasibility of incorporating critically needed wildlife habitat on a landscape scale, with water quality benefits, into production agriculture in eastern North Carolina and Virginia. Working with cooperating producers, including both traditional family farms and corporate farms, a team of wildlife ecologists, integrated pest management specialists, agronomists, and economists has been assembled to implement field border systems around crop fields in several agronomic regions. Field border systems consist of fringe areas of early successional, non-woody vegetation maintained around all the cropped fields on experimental farms. The total area of these systems for any farm unit approximates 5 percent of the cropped acres.

Approach

Project scientists and their graduate research assistants are utilizing Geographic Positioning Systems and Geographic Information Systems to map and analyze how crop yields, pest populations, wildlife populations, and water quality vary within and across study farms. The test farms are located in the Upper Coastal Plain of North Carolina and Virginia, and the Tidewater of North Carolina. Tidewater farms are dedicated to grain production on drained wetlands, with clearly delineated drainage ditches and canals, on which field border systems have been or will be established. Upper Coastal Plain farms in North Carolina produce grain crops, tobacco, cotton, and peanuts. The farms in Virginia incorporate grain production into dairy operations. In each agronomic region, control farms or farm units of comparable size and characteristics, but lacking field border systems, have been identified. Each experimental unit exceeds 1,000 acres, making this research truly a landscape scale experiment. This scale is necessary due to the mobility of wildlife within the agroecosystem, as well as the cumulative impacts of field practices on water quality.

Results

In this, the first full year of the work, we have established baseline data for wildlife on experimental and control farms. We found no significant differences on farms within an agronomic region. This is important, because in subsequent years we expect a marked improvement in bobwhite quail and songbird populations. Our protocols for Integrated Pest Management and water quality work are being established this winter; measurements in these areas will begin with the 1997 growing season. The economic implications of field border establishment are being investigated through field measurements of crop yields at crop field edges on farms with and without field borders. Maintenance cost for field border systems is being evaluated by comparing mowing to herbicide treatment via the new *Weed Sweep* machine, adapted especially for this project. These data will be entered into agronomic models of crop production to generate net profitablilty estimates for farm units with and without field borders. Also, we are conducting an economic analysis of the demand for high quality bobwhite quail hunting to generate possible returns to the producer for establishing and maintaining field border systems.

Knowledge of this project has been spread by word of mouth through the agricultural community in eastern North Carolina, which is likely the most convincing way to interest non-cooperating producers and public agency professionals in the region. This has been supplemented by articles in 12 local newspapers, coverage on public television (*Carolina Outdoors Journal*, WUNC), and five articles in state and national magazines and newsletters. The work is well known among professional wildlife biologists in the southeastern United States for its innovative approach to establishing productive wildlife habitat on intensely farmed lands. The project successes and anticipated benefits have encouraged Natural Resource Conservation Service administrators to ensure that new regulations being developed for the 1996 Farm Bill (EQIP and WHIP) are compatible with the project.

Impact of Results

These early results indicate that this project will have significant implications for agricultural sustainability. It may be demonstrated here that establishment of critically needed wildlife habitat that also fulfills water quality objectives may

be economically feasible. Economic feasibility will depend upon consumer demand for high quality quail hunting, least cost establishment and maintenance of wildlife habitat, and availability of public support for water quality protection. The data from this study should provide all the information needed for producers and public agency administrators to make well informed decisions on a farm by farm basis.

Plans for Remainder of Project

Plans for the project include continuing to measure wildlife response to field border systems, water quality measurements, IPM measurements, and analysis of economic feasibility. Part of the project deals with understanding in detail the interests and reservations of producers to establishing field border systems. Consequently in 1997, we will conduct a series of personal interviews with producers to characterize their perspectives in each of the agronomic regions. Rather than waiting until the end of our field work, we will begin to script and film our project video in 1997. In 1998, when the measurement data are in hand, we will summarize what was learned for reports, scientific publications, extension publications, producer meetings, and professional meetings, as well as for use by the press. We anticipate the high interest this work has generated to intensify when the data are available, and we plan to be ready to make best use of these opportunities.

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Pasture-Based Swine Production Systems for Limited-Resource Farms in the Mississippi Delta

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This demonstration-education project will provide technical assistance to aid limited-resource farmers in adopting a pasture-based swine production system. The design requirements entail low-capital inputs adaptable to farming situations that exist on small-scale farms located in the Mississippi Delta region.

Objectives:

1.) Evaluate various designs for pasture-based pig production and selection of design(s) adaptable to the Mississippi Delta region.

2.) Develop an effective training system to increase the number of limited-resource farmers with technical knowledge of pasture-based pig production.

3.) Provide training and technical assistance to limited-resource farmers to increase the adoption rate of pasture-based pig production in the Mississippi Delta region

4.) Assess the economic and social impact of pasture-based pig production in the Mississippi Delta region.

Two farmer cooperators in the project produce vegetable and row crops, while maintaining small swine herds. One does not own most of the land he farms, so he needs a hog production system that does not require permanent-type housing and other facilities. The other farmer operates small scale mixed livestock enterprises which include, poultry, beef cattle and swine.

The concept of pasture-based systems utilize low-cost portable housing and electric fencing. Most of the information available on pasture-based swine production is based on experiences of midwestern producers. The project will adapt many of these practices to conditions and situations that exist on limited-resource farms located in the Mississippi Delta.

Approach

The approach and methods of this three-year project for the first year focused on social marketing and promoting awareness and interest for pasture-based pig production, system design, evaluation, and selection. One of the first major focuses of the project, which was the establishment of a community-based training and demonstration structure for pasture-based pig production, has been implemented on ALFDC's 266-acre crop, pasture, woodland, and wetland demonstration farm in Fargo, Arkansas.

General Management - A 3.5-acre area was fenced and cross-fenced using two electric wires (12.5 gauge, high tensile). the pasture layout was designed to include 10 paddocks with an average of .3 acres. There are five paddocks on each side of an access lane. Multiple paddocks allows the movement of hogs to different paddocks using the alley. Hogs are moved to different paddocks for three main reasons which include: (1) to accommodate different stages of the production cycle (breeding, gestation, farrowing, etc.); (2) to allow previously occupied paddocks to rest and recover from the effects of animal pressure such as trampling and rooting; and (3) to limit graze hogs on high nutritive value crops.

The water source is an 8-inch, irrigation well that has been filled with a flow restriction mechanism that allows a storage tank to be filled with a two-inch line. The water from the tank gravity feeds through a .75-inch, flexible hose (above ground) to individual 55-gallon, plastic barrels that are equipped with automatic water and float valves. The barrels rest on wooden pallets and can be easily transferred to other paddocks when necessary.

Feeding Management - At this time, hogs are being fed a commercial feed using wooden V-shaped feeders. A set of working pens are presently being constructed in one of the smaller paddocks. Plans are being developed to utilize more "home grown" crops as feed ingredients. Some of these crops will include corn, peas, and sweet potatoes in addition to forages.

Pasture Management - Some of the paddocks have been improved and contain stands of tall fescue and animal ryegrass. The ryegrass will be grazed when soil conditions will support the animals. Other forage crops are being evaluated on site. Fifteen species and species mixtures are being evaluated in a randomized block design to determine yield

Project area
Integrated systems

Project duration
March 1995-Dec. 1998

Budget:

SARE	$274, 412
ACE Matching	$68,852

potential for the soil type and climatic conditions common to this region.

Impact of Results

Total-confinement systems have contributed largely to a steady supply of affordable pork, but they are capital-intensive. Compared with total-confinement systems, the pasture-based systems have shown to produce similar animal performance data and require lower costs in terms of energy, investment and maintenance inputs. This allows outdoor pig producers to feasibly downsize or expand their operation depending on prevailing market conditions. It also allows farmers to utilize rented land.

In addition, the low-investment and maintenance costs associated with pasture-based swine production should increase opportunities for limited-resource farmers an a new generation of beginning farmers. The adoption of a pasture-based swine system by limited-resource farmers in the Mississippi Delta should provide them with a system for diversification and integration of crop and livestock production, year-round employment for the farmer and value-added livestock as the farm's major output.

Therefore, our assumption is that this project will improve the economic well-being of limited-resource farmers thus obtaining our organization's mission of improving their quality of life.

Plans for Remainder of Project

The first year of the project focused on social marketing and promoting awareness and interest for pasture-based pig production, system design, evaluation, and selection. The second and third years will expand outreach thorough training, demonstration and dissemination activities.

A project advisory committee will be formed consisting of farmers and representatives from participating agencies. The committee's function will be to plan and schedule training events, to meet quarterly to assess the progress of the project, to make decisions that will adjust project activities based on intended or unintended developments, and to oversee all project operations. Also, we will select two other demonstration sites of two privately-owned farms in Arkansas.

Outreach

Tours were organized for interested farmers to visit two outdoor swine operations in souther Missouri. Farmers were able to interact with the managers of these operations and received valuable knowledge and insight on how a low-input, outdoor system operates.

The demonstration site at the ALFDC Fargo site is now operational and plans are being made to have our first field day. Some farmers have already toured the site individually and during the recent ALFDC annual conference in which two (2) tours were conducted. During these times, farmers were able to offer suggestions relating to the design, construction, and implementation of the system. At this conference, over 100 youth were present at a session in which outdoor swine production was discussed.

Last summer the youth involved in the YEA-AIM program were given a tour and information on the project design. Some of these youths also helped with the construction of electric fences and with the construction of hog shelters. Also last summer, representatives from the W. K. Kellogg foundation were given a tour of the demonstration site and information on the plans for this project. This meeting was also attended by farmers.

Mr. Walter Johnson's swine operation was toured by ASU and ALFDC staff. During this time Mr. Johnson was given suggestions on how to improve his operation. Other farmers will be visited in the near future to evaluate potential sites and to discuss plans for developing an outdoor swine production system on their farm.

A video has been made at Arkansas State University that covers the design and construction of one of the farrowing huts that is being used. The video includes helpful hints and a list of tools and materials the farmer will need to construct the hut. A fact sheet will also be made available to farmers covering the construction of huts. Plans needed to construct several different types of huts have been made available to farmers as well.

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Southern Region

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Using Farm Family Case Studies to Teach Sustainable Agriculture

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Cooperators continued on next page

Project area
Integrated systems

Project duration
March 1995-Dec. 1997

Budget:
SARE $146, 630
ACE
Matching $137,090

Without effective, efficient, and stimulating methods to reach and train producers about the advancements occurring in sustainable agriculture production, the development of new techniques would have academic, but very little practical value. The goal is widespread adoption of proven sustainable technologies on farms worldwide. The challenge is to be as equally creative, diligent, and effectual with our educational outreach as we are productive in research and development.

The purpose of this project is to use a creative multi-media approach to extend the experiences and results of an on-farm sustainable farming demonstration project and to encourage widespread support and adoption of sustainable agriculture practices. Educational videotapes and supporting written materials featuring a variety of farm types in Kentucky, Mississippi, and Tennessee are being developed to educate producers, community leaders, and school children throughout the United States about the value of sustainable agriculture and the challenges and benefits in applying sustainable technologies to the farm.

Objectives

1.) Develop five case studies of authentic farm families that have employed sustainable agricultural production practices on their farms. Prepare for a farm audience a 50-60 minute video that documents the successes and challenges of these families in adopting sustainable agriculture practices and the specific economic and environmental impacts that have resulted.

2.) Prepare supporting written materials to accompany the case study video that includes a facilitator's guide, detailed economic and environmental analysis, and evaluation forms.

3.) Prepare for a non-farm audience a 10-12 minute video emphasizing the beneficial impacts of sustainable agriculture on the community. Prepare public service announcements for broadcast by network and cable television.

4.) Develop up to five condensed versions of the video for public school teachers to pilot-test in their classrooms and to complement the Ag in the Classroom curriculum. Construct lesson plans to accompany the video and facilitate its use by teachers unfamiliar with agriculture.

5.) Distribute one copy of all materials to each 1862 and 1890 land-grant university.

6.) Present the concepts of sustainable agriculture to 500 farmers in Kentucky, Mississippi, and Tennessee by conducting 25 educational meetings and presentations. Educate 300 extension agents and other agriculture professionals about sustainable agriculture through in-service training.

Approach

This project is benefitting from an ongoing five-year whole-farm demonstration project called Agri-21 Farming Systems. Agri-21 is a program designed to help farmers move towards a more sustainable operation. Following an intensive evaluation of selected farms, cooperating Agri-21 producers and project participants developed whole-farm plans detailing an approach to more profitable, environmentally friendly operations. Various sustainable technologies have since been adopted on each participating farm. Throughout the Agri-21 program, now in its fifth year, comprehensive sets of economic and environmental data were gathered and analyzed, and these data and results are being used in the development of the five case study farms highlighted in the video.

The video will briefly tell the story of the case study farms, with the majority of information presented by the cooperating farmers. For each farm, family goals and two sustainable themes particular to meeting those goals will be discussed. A total of 10 different themes, two for each case study farm, will be featured.

A written facilitator's guide will accompany the video for use by agricultural extension educators. The guide will provide an overview of the case study video, suggest methods in which the case studies can be used to achieve a set of educational objectives, and provide suggestions for stimulating group discussions.

After draft versions of all materials are developed and approved by the steering committee, evaluation meetings will be conducted with farm and non-farm audiences. The focus of these meetings will be to obtain feedback on the qual-

ity of the material presented, the value of the information presented, and the appropriateness of the facilitator's guide. The feedback will direct final revisions of the draft videotape and facilitators guide.

A copy of the completed materials will be distributed nationwide to each 1862 and 1890 land grant university. The materials will include complete instructions on effective usage of the videos and will require little or no pretraining of educators prior to their adoption and use. The case study materials will be used by the cooperating project states to present concepts of sustainable agriculture to at least 250 individuals over a two-year period.

Following the evaluation and completion of the case study video and facilitator's guide, a youth project steering committee will be appointed to develop a shorter version of the materials for use in teaching youth. This steering committee will include teachers, extension youth educators, and school administrators. The charge of this steering committee will be to guide the adaptation of the case study video for use with youth audiences, and to assist in the development of lesson plans or projects to accompany the youth video.

A pre-test and post-test will be administered to audience members to measure the viewers knowledge and understanding of sustainable agriculture before and after they view the videotape. Farm audiences will be asked to hypothesize changes they might make to improve their sustainability. If time and resources permit, a follow-up evaluation of audience members will be conducted six months after they view the project materials to determine what changes they have implemented. This will provide some measure of the impacts of the materials.

Results

The project has prompted the formation a steering committee with a wide range of agricultural and video expertise. The steering committee is composed of 13 professionals including a video writer/producer, videographer, agricultural extension personnel, agriculture educators, and a producer. The steering committee has set selection criteria for case study farms and assisted in selecting the farms to be used as case studies. Members of the committee also conducted an extensive review of videos on sustainable agriculture topics to study how this subject has been approached by others.

Five farms from the Agri-21 Farming Systems project in Kentucky, Mississippi, and Tennessee have been selected. Two themes in sustainability have been developed on each farm, and videotaping has commenced. Each farm has been visited at least twice by the video crew. Approximately 10 hours of rough footage has been collected, including interviews with producers, agents, and teachers, and farm activities over two seasons, two field days, and a teacher in-service.

Preliminary treatments and scripts have been written and reviewed, and script development is ongoing. Other activities include logging all videos and collecting additional stock footage, such as aerial photography, from outside sources.

Impact of Results

The major impact expected from the completion of this project is increased awareness, support, and adoption rates of sustainable agriculture production by both farm and non-farm audiences, including producers, extension agents and specialists, policy makers, teachers, and school children.

Potential Contribution

Producers who watch this video will benefit from the lessons learned by others who have employed sustainable agriculture practices on their farms. As a result, producers will make more informed decisions when adopting sustainable technologies on their own farms. More informed decisions could potentially yield increased farm profitability, decreased negative environmental impacts on and off the farm, greater efficiency in farm management, an edge in competitiveness, and an enriched life for the farm family.

Consumers, in turn, will benefit by farmers' increased adoption of sustainable technologies. The food and fiber supply will continue to be safe, reliable, affordable, and fresh. Consumers will continue to enjoy clean air and water, a more stable economy that includes turnover of farm resources, enhanced quality of life, and better health. The community will also continue to benefit from farm family involvement and leadership in community activities.

Plans for remainder of project

Plans for the remainder of the project include the continuation of filming at farms as the seasons change and farm activities shift, development of scripts, logging and editing of the videos, preparation of educational materials, pilot-testing and distribution of the videos, and all educational outreach activities as outlined above.

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Managing Soil Phosphorus Accumulation from Poultry Litter Application Through Vegetable/Legume Rotations

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Cooperators continued on next page

Project area

Waste Management

Project duration

March 1995-Dec. 1998

Budget:

SARE	$135,000
ACE	
Matching	$90,813

Nitrogen (N) - phosphorus (P) - potassium (K) ratio in poultry litter does not match the ratio of nutrients required by vegetable crops. As a result, complete nutrient utilization is rarely accomplished. Litter application rates are generally based on crop N requirements. Most research to date has been concerned with fate and management of soil nitrate - N supplied by poultry litter. Little information is available concerning the fate and management of litter supplied P in the soil. When litter is applied to meet the N needed, P and K can accumulate. Excess accumulation of P can be detrimental to plant growth and increase the risk of non-point source pollution of surface water. Excess K can have negative effects on soil salinity and lower availability of magnesium to plants.

Objectives

1.) Investigate the use of warm- and cool-season legumes and legume-grass mixes in rotational cropping systems to remove excess P supplied by poultry litter;

2.) Evaluate cool-season legumes for P uptake efficiency following litter application rates on spring vegetables

3.) Monitor P, and K accumulation, N leaching, and P runoff in a vegetable-forage legume rotation system

4.) Demonstrate use of annual legumes in cropping systems, utilizing poultry litter as a nutrient source, on grower-owned land under grower conditions.

Approach

The litter rates applied for all objectives were based on soil test nitrogen (N) requirement of the vegetable crop and percent N content of the litter. This was considered the 1X rate. Litter was applied to the vegetable crop only. Treatments were incorporated immediately after application by power tilling.

Treatments in objective 1 consisted of cropping system (spring legume-fall vegetable) with litter rate (0, 1X, 2X, 4X, and commercial blend). Watermelons were the vegetable crop in the spring and broccoli in the fall. The spring legume crop was iron and clay cowpeas and the fall crop was crimson clover. Data were collected on yield, plant P concentration and P uptake. Soil samples were obtained at depths of 0-6 in., 6-12 in., and 12-18 in.

Dry matter yield was not affected by litter rate or blend for either the spring or fall legume. Plant P concentration increased for both legumes as rate increased. In both cases concentration from the blend was equal to the 4X litter rate. Phosphorus uptake increased as rate increased in spring 1995 but demonstrated no difference in 1996. This could be attributed to a dry spring in 1996 which reduced yield. Phosphorus uptake by crimson clover increased as litter rate increased. An increase in soil P was found at the 0-6 in. and 6-12 in. depth as rate increased. The greatest reduction in soil P at the 0-6 in. depth was from a system of spring vegetables-fall legume.

In objective 2, litter was applied in the spring each year to the vegetable crop only. The rates were 0, 1X, 2X, 4X, and commercial blend. In fall 1995, cool-season legumes consisting of crimson clover, berseem clover, hairy vetch, and red clover were seeded. Due to loss of stand of berseem clover because of freezing weather, a crimson clover-ryegrass mix was substituted in the 1996 planting. Data were obtained on yield, plant P concentration, P uptake and soil P concentration at depths previously mentioned. Hairy vetch showed the highest yield and plant P concentration. It also showed it had the ability to remove more P than the other legume species. The least amount of soil P concentration was from hairy vetch.

In objective 3, cropping systems of spring vegetable-fall legume, spring legume-fall vegetable and spring vegetable-fall fallow were studied. Fertility treatments consisted of 0, 1X, 4X and commercial blend. In 1995, the fall vegetable was turnip and the cover crop was crimson clover. In 1996, the spring vegetable was sweet corn and the cover crop was iron and clay cowpeas. Data were obtained on yield, plant P concentration, P uptake, and soil P concentration. No run-off data were obtained due to dry conditions in both seasons which produced very little precipitation. In this study, no significant differences in crimson clover or cowpea yield,

plant P concentration or P uptake was found. The data, however, did suggest an increase in plant concentration and uptake. Soil P concentration increased as rate increased. A system of fall legumes-spring vegetables reduced soil P in the surface 0-6 in. depth.

Objective 4 was implemented in spring 1996 with the establishment of two demonstration plots. One was on the George Millard farm in Nacogdoches County and the other on the Rollie Skinner farm in Cherokee County. Soil samples were obtained before plot establishment to determine residual P. On the George Millard farm, litter was applied and tomatoes planted. In fall 1996, soil samples were obtained for P determination from two areas which had previously been planted to onions in the spring and Elbon rye the previous fall. Hairy vetch was seeded on these areas in Fall 1996. Yield and soil samples will be obtained in spring 1997. On the Rollie Skinner farm, litter furnished by George Millard was broadcast applied on one-half of a 0.25 acre plot and commercial blend applied to the other half. Sweet corn was planted on the whole plot. Yields were obtained and soil samples were taken for residual P determination. In fall 1996 hairy vetch was seeded. Yields and soil samples will be obtained in spring 1997.

Results

The data collected to date indicate that a cropping system approach utilizing fall legumes as a cover crop could be one way of reducing soil P accumulation from applied litter. Hairy vetch appears to be most efficient in uptake of P. Due to demonstrations of litter use in vegetable production programs, grower interest and awareness of the nutrient value of poultry litter has been increased. Continued demonstrations will help to show growers how a cropping system approach can be used to alleviate problems associated with litter use, especially P accumulation.

Plans for Remainder of Project

Plans for the future are to continue this research effort. Also, through outreach programs, we will continue to educate growers on nutrient management strategies through environmentally sound best management practices.

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Effects of Organic and Chemical Fertility Inputs on Soil Quality in Limited-Resource Vegetable Farms

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Producers

Project area
Limited resource farms

Project duration
March 1995-Dec. 1998

Budget:
SARE $184,319
ACE Matching $56,952

Small market biological vegetable farmers produce high economic return crops whose continued success is dependent on maintaining or enhancing the quality of their soil. The overall goal of this project is to research the effects of conventional and alternative fertility practices on the biological, chemical, and physical attributes that constitute soil quality and influence crop yield on six limited resource vegetable farms in the mid-Atlantic region, and extend results to farmers, educators and researchers.

Objectives

1.) Assess the effects of organic and inorganic soil amendments on selected soil biological, chemical, and physical properties indicative of soil quality on limited resource vegetable farms in the mid-Atlantic region.

2.)Teach vegetable farmers to perform simple on-farm tests to determine the effects of their production practices on soil quality.

3.) Develop fact sheets for distribution to farmers on:

a.) Effects of organic and inorganic fertility on soil quality, and

b.) Sampling and monitoring soils for indicators of quality.

4.) Conduct field days for farmers, extension agents and educators, agricultural consultants, and researchers to share the results of the field studies and the methods that farmers can use to monitor soil quality.

5.) Present the results of the effects of organic and inorganic fertility on soil quality and a practical guide to monitoring soil quality at the Virginia Sustainable Agriculture and the Carolina Farm Stewardship Association conferences.

6.) Write research articles on the effects of organic and inorganic fertility on soil quality.

Approach

The farms are located in the Coastal Plain and Piedmont soil provinces. Three farms produced sweet corn and three farms produced cucurbits (cassava melon and watermelon) during the first year of the study. Three of the producers were long term biological farmers and three had a history of chemical weed and insect control. Two fertility treatments, a conventional treatment using commercial fertilizer and an alternative treatment using an available organic fertility source, were employed. The conventional fertilizer was a mix of ammonium nitrate (33.5-0-0), triple superphosphate (0-46-0), and muriate of potash (0-0-60) mixed to meet the soil test recommendations of nitrogen (N), phosphorus (P), and potassium (K) for each farmer's specific crop and pre-existing soil test level. The alternative fertility sources, composted cotton gin trash compost (threefarms), composted yardwaste and manure (two farms), or beef manure (one farm), were applied at rates to meet the nitrogen needs of each crop according to estimated N availability. Experimental plots measured 25 feet by 25 feet, and each treatment was replicated three times.

Fertility sources were applied onto plowed and disked or roto-tilled soils in spring 1996 (except one late season corn site, where soil preparation, fertilization and planting occurred in August) and immediately cultivated into the soil. Corn seed was planted or melons were transplanted within one week of soil fertilization and amendment addition. Farmers implemented their normal practices, except no herbicides, insecticides, of fungicides were used.

Soil was sampled when the melon vines began to run and at corn silking for available nutrients, organic matter, and microbial indicators. Immediately following harvest, soil was sampled for bulk density, water-holding capacity, aggregate stability, and the microbiological indicators. Fresh yield was determined by collecting and weighing all corn ears and melons from 12-foot sections of each of two center rows from each plot. The corn growth at the late-season planted location was assessed by sampling total stalk dry weight because corn earworms and an early frost prevented ears from forming.

Results

The alternative soil amendments increased soil concentrations of most nutrients above that of the commercial fertilizer because the alternative amendments were a rich source of most essential nutrients, but only N, P, K, and, sometimes, limestone was recommended for the conventional treatment. The organic amendments

tended to increase soil pH, organic matter, and total C above that of the commercial fertilizer, but no first year effect on soil bulk density occurred.

Some interesting trends have emerged from analysis of the biological samples removed at planting and harvest at the six on-farm locations. The most striking trends are between the historically organic and conventional farms. Two historically organic farms had higher numbers of the beneficial soil fungi *Trichoderma* and *Gliocladium* species initially at planting then the other farms. Populations of *Trichoderma* and *Gliocladium* species increased over time in the three historically conventional farms and were greater in plots treated with organic than inorganic fertilizers at harvest. These microorganisms have been demonstrated to play a role in biocontrol of soilborne pathogens. Numbers of thermophilic microorganisms (mostly species of Actinomyces and Streptomyces) also increased over time at most sites and were also higher in plots treated with organic than inorganic soil amendments. Our data indicate that beneficial soil organisms can be increased via organic amendments. None of the grower fields had significant levels of recognizable soilborne diseases this season; plant pathogenic oomycete fungi (*Pythium* and *Phytophthora* species) increased with time and were greater in plots treated with inorganic fertilizers than organic amendments at harvest.

Despite the beneficial effects of the alternative fertility sources on soil chemical and microbiological properties, the organically fertilized treatments did not yield higher than those commercially fertilized. Available N may have been lower from the alternative source than from the commercial fertilizer, but soil N analyses have not yet been completed for verification.

Impacts of Results

Sustainable agricultural systems require that non-renewable resources not be depleted and air, water and soil quality be maintained or improved. Recycling of organic "wastes" as soil amendments and fertility sources for agricultural soils can slow the depletion of oil and mineral reserves by substituting materials normally diverted to landfills for commercial fertilizers, whose mining is environmentally degrading and production is energy-intensive. Furthermore, recycled organic wastes provide organic matter, an important constituent of biologically active and productive soils, which is not found in commercial fertilizers. The first year's results indicate that the nutrient value of waste-amended soils can be raised above that of commercially fertilized soils, and that initial yields with wastes can be comparable to those of commercially fertilized soils. In addition, organically managed soils have higher populations of beneficial and lower populations of pathogenic microorganisms, which may predispose conventionally fertilized soils to greater incidences of disease. Continuing study will determine whether long-term fertility, soil quality, and crop productivity can be enhanced with organic fertility sources.

Potential contributions

The use of organic soil amendments may result in a soil that has greater capacity to resist the spread of plant pathogenic organisms; thereby, requiring reduced use of fungicides. This can lower farmers' costs and the risk of pesticide contamination of food. The improvement in overall soil quality may reduce the potential for nutrient contamination of ground and surface water and produce more vigorous-growing and high-yielding crops. Many potential sources of organic soil amendments are currently buried in costly landfills or underutilized in relation to commercial fertilizers. Increasing use of composted wastes will reduce the costs of landfilling wastes and the environmentally damaging (mining) and energy intensive (petroleum-based) fertilizer production practices.

Plans for Remainder of Project

The remaining soil chemical, physical, and biological analyses from the first growing season will be conducted this winter. In addition, a greenhouse study will be conducted to determine better estimates of N availability from the cotton gin trash and yard waste composts to refine next season's application rates. Farmers have prepared their fields for next season's crop, which will be tomato at all locations. Research assistants and principal investigators will work with producers to provide training in the use of simple, in-field soil quality tests and data will be collected to determine the accuracy of the quick tests. The producers' use of the kit will permit greater understanding of the impact of various practices and empower producers to redesign their production systems based on their own observations and measurements.

Principal investigators, graduate research assistants, and producers will plan and design field days, present study results at workshops presented at the Virginia Sustainable Agriculture Conference and the North Carolina Farm Stewardship Conference, and jointly author extension facts sheets, and research articles. The fact sheets will be available at the field days and the Virginia and North Carolina sustainable agriculture vegetable conferences, mailed to members of the Virginia Association for Biological Farming and the Carolina Farm Stewardship Association, and provided for Cooperative Extension agents to disseminate at their programs and field days.

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Developing Municipal/Farm Linkages for On-Farm Composting and Utilization of Yard Wastes: A Regional Resource Issue Project

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All farmers

This project was designed to develop and document a process to divert municipal yard wastes, a natural resource, to farms for composting and agricultural use. Program objectives include:

1.) Develop an approach to link municipal waste authorities and farmers for recycling and utilization of yard wastes in agriculture;

2.) Ensure successful composting by farmers by providing technical and economic training and assistance;

3.) Promote on-farm composting by developing and conducting educational programs for farmers and agricultural professionals;

4.) Demonstrate the benefits of compost application on soil, physical, chemical and biological properties and crop growth in on-farm tests; and

5.) Develop a manual, in hard copy and electronically formatted, that provides a framework for use by waste managers for implementing a yard waste distribution and on-farm composting program.

Approach

Extension project coordinators collaborated with the Rivanna Solid Waste Authority (RSWA) to develop a plan to deliver leaves collected in the fall and winter of 1994 and 1995 to area farms. The RSWA and local Extension personnel solicited farmer participation through advertisements and personal contact. Two informational meetings were held to present the details of the program. Six farms, including landscape/nursery, organic vegetable production, and beef cattle operations, participated in the program.

An educational program was developed for participating farmers. The program included: a) a field trip to visit an on-farm composting operation in northern Virginia; b) a 30-page resource guide on composting that contained tables and charts for recording project expenses, and process information was written and provided to each of farmer participant; c) economic training for participants was conducted to enable an assessment of the composting operation and the value of the end-product.

Five farms each received between 180 and 250 cubic yards of bulk leaves in mid-March of 1996. The sixth received approximately 160 tons (~990 cubic yards) of bagged leaves which were debagged by municipal workers at the farm. The total volume of leaves delivered to all six farms was approximately 2600 cubic yards. All but one of the operations co-composted the leaves with chicken or turkey litter from production operations in nearby counties. Windrow construction and turning/mixing was accomplished with a tractor and bucket and, sometimes with a manure spreader. Four of the participating farmers utilized a RSWA tractor-pulled type windrow turner to turn their compost at least three times. Additional turning and mixing was conducted with a tractor and attached bucket or fork. Project personnel made regular farm visits to provide composting technical support.

Three on-farm field and greenhouse studies are currently in progress to demonstrate the effects of compost vs. commercial fertilizer on soil physical and chemical properties and plant growth. Economic evaluations that compare the expenses of leaf and manure delivery, composting, and compost utilization with the expenses of landfilling wastes and commercial fertilizer.

Project outreach activities have included : a) an On-Farm Composting Field Day to demonstrate the windrow system at a participating farm and an aerated static pile system at a nearby farm; b) a municipal yard waste composting educational forum, sponsored by the Virginia Recycling Association Organics Recycling and Composting Committee; c) dissemination of program development and progress through a poster at the Composting Council's annual conference and presentations at the annual Composting in the Carolinas Conference and the annual Virginia Sustainable Agriculture Conference; d) the production of articles and publications for extension agents and farmers; and e) an educational seminar to assist extension personnel, waste managers and farmers in the development of a leaf distribution and composting project in another Virginia county.

Project area
Waste management

Project duration
July 1995-Dec. 1997

Budget:

SARE	$69,167
ACE Matching	$24,522

Results

Finished compost has been used in organic vegetable production and landscaping projects, sold in bags from a nursery retail operation, and sold in bulk from at least one farm. The range in cost for labor, co-composting materials, and all equipment use except the windrow turner for the four farms, which used the turner was $4.36 to $17.40/cubic yard of finished material. The highest cost was incurred in extensive windrow construction activities due to the inflow of many more leaves than originally planned and other unanticipated circumstances. All of the participants plan to continue composting for on-farm use or sale of the finished material, with at least two continuing their composting activities at the new scale or larger. One of the participating farmers has signed a five-year contract with the City of Charlottesville to receive at least 1,000 tons of leaves annually, indicating the economic attractiveness of the program to waste managers.

Outreach activities have successfully reached other waste managers, farmers and educators. Thirty-one people attended the on-farm composting field day. The Municipal Yard Waste Composting Forum drew approximately 30 participants. The poster session at the Composting Council Conference reached more than 200 individuals. Approximately 25 people attended the presentations at the Virginia Sustainable Agriculture Conference and the Composting in the Carolinas Conference. In addition, waste managers and farmers in two other counties have requested information and guidance in developing similar programs for their areas.

Impact of Results

Establishing linkages between the agricultural and waste management communities can help all parties realize the benefits of municipal yard waste recycling on farms. Composting yard wastes with farm wastes can produce a valuable soil amendment and reduce the burden on urban and suburban landfills. This approach serves the goals of sustainable agriculture by enhancing agricultural and horticultural soil productivity, protecting water resources, and reducing the use of non-renewable resources.

Potential Contribution

This project is demonstrating that increasing waste recycling through composting of municipal yard trimmings and agricultural manures on farms can be an attractive opportunity for many farmers and an economical option for waste managers. Publications providing guidelines for establishing linkages and illustrating how a collaborative information and education program can ensure success will promote similar partnerships throughout the South.

Plans for Remainder of Project

Additional outreach activities will include a spring 1997 field day to demonstrate the beneficial effects of compost use in agriculture and to present project results and economics. Three extension publications will be completed and disseminated: 1.) *A Farmer's Composting Guidebook I*, addressing raw materials, process principles and management, and compost application; 2.)*A Farmer's Composting Guidebook II*, addressing planning and siting an operation, the economics of composting, and Virginia regulations; and 3.) a handbook documenting the project and providing guidelines for other waste management entities and/or groups of farmers and others to utilize for similar programs. Guidebook abstract, highlights and program component summaries will also be available through the VCE web site. Research results will be published in appropriate journals, newsletters and extension bulletins.

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Agronomic and Economic Benefits of Intercropping Bean with Banana

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Objectives

The project is intended to determine agronomic and economic benefits by intercropping bean with banana. There are three objectives:

1.) Determine the effects of planting time and frequency of bean on yield and quality of banana.

2.) Determine additional benefits of intercropping as contribution to nitrogen fertility, weed control and soil and water conservation provided by intercropped bean.

3.) Determine the economic feasibility of the best planting time and frequency of bean/banana intercropping on a semi-commercial scale.

Approach

For fulfilling the first objective, two bean cultivars, Arroyo Loro and 9443-1, have been intercropped once or twice with a banana cultivar, Grand Nain, in the first field experiment. The experiment is currently being conducted on a private farm located in Aguas Buenas, Puerto Rico. We have completed harvesting a series of bean intercropped with banana at four different timings and two frequencies. The best timing and frequency were found to be the November planting of banana intercropped with two consecutive crops of bean. The banana yield of this experiment is still pending for harvest.

For fulfilling the second objective, soil and banana leaf tissue samples were collected periodically from the field experiment and analyzed for total nitrogen content under laboratory conditions to determine the contribution of bean plants to nitrogen fertility in soil and banana leaf tissue. Preliminary data from soil analyses indicated that the contribution of bean plants to soil total nitrogen content is minimal. The leaf tissue analysis indicated that there was no detectable contribution of nitrogen to the intercropped banana plants. The contribution of bean plants to weed control was also determined from the same field experiment by counting weeds present in plots after each harvest of the bean. The shading effect of bean canopy had significantly reduced the weed population in the intercropped plots in November and January plantings of banana, but its effect was not evident in March and May plantings. We are still in the process of collecting biomass data and soil loss data for the determination of soil losses under bean-intercropped and banana monoculture conditions.

A semi-commercial field experiment on bean/banana intercropping was initiated in November 1996, to fulfill objective 3. The best bean cultivar, Arroyo Loro, was selected for economic viability study in this experiment. A partial budget analysis will be used to determine the economic feasibility of adapting bean/banana intercropping technology to commercial production.

As soon as this technological package of intercropping bean/banana is developed, extension specialists will be able to recommend to local farmers the best bean cultivar, the best timing and frequency of intercropping, and economic and agronomic benefits associated with this farming practice.

We are expecting to complete the harvest of banana for the two field experiments, to terminate all laboratory analyses of soil and plant tissue samples, and to perform economic analyses of the feasibility of bean/banana intercropping for the remainder of the project. As you may be aware, banana is a long term crop requiring 12 to 14 months to harvest a crop. Data collecting for this crop is a slow process; so far, we are progressing according to the schedule.

A field day was held at the farm in February 1997. Despite hazardous roads and rainy weather, 11 people attended. These included two agronomists, two commodity specialists, an extension agent and several farmers. The attendees were brought up to date on the findings produced by the first two years of the project.

Project area
Cropping Systems

Project duration
March 1995-Dec. 1998

Budget:

SARE	$99,845
ACE Matching	$50,239

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Soil Conservation and Pest Management Impacts of Grass Hedges

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Objectives

1) Evaluate erosion-control effectiveness of grass hedge field plantings established according to existing USDA-NRCS draft interim practice standard.

2) Increase understanding of response of arthropods in cotton production systems when permanent grass hedges are implemented.

3) Increase information delivery of grass hedge technology to limited-resource farmers.

4) Evaluate farmer responses to farming with grass hedges and share experiences with others.

5) Incorporate new knowledge and experience obtained through objectives 1 to 4 into improved USDA-NRCS standard and specification for this practice.

Approach

Erosion control effectiveness was evaluated by surveying fields where hedges had been in place for periods up to five years. Data from these surveys were compared with surveys made in these fields in previous years to determine landscape changes. Rainfall was measured at the experimental fields to allow development of a computer model to permit extrapolation of observed data to other fields and into the future.

Studies were conducted to determine the impact of mowing hedges on hedge stem size and stem density, two properties that affect a hedge's ability to remain erect and effective in trapping eroded sediment where runoff concentrates.

Insects were monitored with pheromone traps and, later, with sweep nets in four fields in Mississippi and Arkansas. Insect population, crop growth and yield samples were taken in transects oriented perpendicular to the grass hedges. Rows 1, 2, 3, 5, and 13 were sampled along with cotton remote from the hedges.

New hedges were established, with participation from local District Conservationist and County Agent on the vegetable farms of Brybena Wyatt and Harris Virden. New hedges were established in cotton fields farmed by John Briscoe, Bary Beard, and Billy Baker.

A field day attended by 200 farmers and farm advisers was held at the Judd Hill Plantation in Trumann, Arkansas where this grass hedges research was one of four featured projects. The annual meeting of the national Grass Hedge Working Group was hosted in Oxford and several of the study fields were visited by 35 participating researchers, conservationists, and farmers. Preliminary soil conservation and entomological results were presented at the 9th Conference of the International Soil Conservation Organization (ISCO) in August, 1996.

Results

Grass hedges are narrow (~1 m) parallel strips of stiff, erect, grass planted near to or on the contour of fields but crossing swale areas at angles convenient for farming. They serve as guides for contour cultivation, retard and disperse surface runoff, cause deposition of eroded sediment, and reduce ephemeral gully development. Five years after switchgrass (*Panicum virgatum* L.) hedges were planted in a 10-ha field in northern Mississippi, landform changes were large enough to alter future runoff and erosion patterns. Grade of 15-m wide cropped intervals between 1-m wide hedges was reduced from 9 percent to 7 percent m/m as a result of surface lowering immediately below hedges and on the shoulders of swale areas combined with increases in elevation immediately above hedges. Analysis of annual surveys made on another hedged field in Coffeeville, Mississippi from 1993 through 1996 show progressive lowering of high spots and filling of low spots as contours lines more closely aligned with hedges composed of a variety of species. At this site, slopes of the cultivated area were reduced from 7% to 5% and even hedges composed of fine-stemmed grasses were effective under these conditions where intense concentrated flow of water does not occur.

Cotton and soybean yields were reduced in the row adjacent to the hedges where the hedges were not mowed early in the season. These findings combined with the Coffeeville survey results suggest that a short-growing grass varieties can and should be used in hedges where they are not crossing concentrated flow areas.

Project area

Soil conservation

Project duration

June 1996-December 2001

Budget:

SARE	$137,352
ACE Matching	$150,000

Mowing grasses resulted in a hedge comprising denser but finer stems. Mechanical analysis of hedge strength has shown that resistance to bending stems (moment of inertia) is proportional to the fourth power of stem diameter. Making a stem half as big, makes it 16 times less stiff. Mowing resulted in an overall reduction in hedge strength and hence lower ability to resist concentrated runoff. Hedges should not be mowed in areas of a field where runoff concentrates.

Analysis of preliminary insect sweep data demonstrated that hedges increase abundance of both beneficial and pest arthropods. Weeds growing in conjunction with the switchgrass may have a larger impact on insect populations than switchgrass itself. Mowing and herbicide management can have a great impact on these associated plant populations in grass hedges.

New switchgrass hedge plantings established well in 1996 at most locations where 20 to 30 lbs of seed were planted per acre. The Port Gibson, Mississippi seedings suffered because 400 lbs/a of seed was planted and the seedlings were too crowded. Despite this setback, the cooperating farmer is enthusiastic and it is hoped that the surviving plants will be at an appropriate density in 1997.

Impact of Results

This project offers farmers an inexpensive biological water erosion control alternative that is compatible with all tillage systems. Hedges may replace costly terraces and are appropriate to land where terraces cannot be constructed either because of shallow soils or the lack of an appropriate outlet. On flat sandy lands, hedges can control wind erosion and improve water quality. Hedges increase habitat diversity and, depending on layout and management, may have important integrated pest management and wildlife benefits.

The preliminary results of this project have already had a significant impact. The Grass Hedge workshop held in Oxford was attended by researchers and action agency representatives from all parts of the country. The chairman of the USDA-NRCS National Practice Standard Subcommittee, Chuck Lander, participated. Groundwork was laid so that the results of this project will be considered modifications to the draft interim practice standard are made and grass hedges (or "Vegetative Barriers") becomes an official practice in the National Handbook of Conservation Practices. Connections were made so that standards will soon be developed and implemented in a number of states even before the national standard is finalized, thereby making hedges an approved technology for inclusion in NRCS farm plans needed for conservation compliance.

Plans for Remainder of Project

In the coming years, winter temperature regime in hedges will be monitored to determine the value of hedges as overwintering habitat for insects. The impact of hedge mowing regime on arthropod pests and beneficial insects will continue to be studied. The attitudes of farmers participating in this project toward grass hedges will be assessed and their experiences will be reflected in future hedge design standards. A computer model to assist field offices in hedge design and layout will be developed. It will predict long term (50 to 100 year) landscape changes resulting from farming between hedges and the impact of these changes on future soil productivity, runoff, and erosion.

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Improving Integrated Resource Management Skills of Beef Producers

Project Coordinator

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Cooperators continued on next page

Project area
Integrated Resource Management

Project duration
April 1996-December 1999

Budget:

SARE	$163,642
ACE Matching	$330,313

Objectives

1.) Identify technological tools supporting integrated resource management (IRM) and incorporate them into ongoing educational efforts to teach beef producers how to use the tools for better decision-making

2.) Develop case studies to document existing IRM practices and identify factors critical to successful IRM.

3.) Build on previous programs to identify IRM research and education needs and continue to increase awareness of IRM concepts.

Approach

Fifteen in-depth case studies of beef producers will be completed in the three states. Special efforts will be made to ensure a variety of farm types and management styles, including beginning and small farms. Interdisciplinary IRM teams will visit farms, help participants assemble financial and production data, and discuss potential changes in management. Strengths and shortcomings in farm management information systems on participating farms will be noted. Common themes which emerge will be identified for generalization and consideration by other farms. Case study data will be further examined to find measures of performance common across case studies which are outside "reasonable" ranges, identify practices which support IRM and are transferable to other farms, and note innovative marketing and income diversification alternatives. Having an IRM team maintain a continuous relationship with managers should provide unique insights compared with periodic one-to-one contact by disciplinary specialists.

A general protocol for information to be collected will be constructed. Potential sources of information are records, interviews, and observation. Data collected will focus on management structure, goals, enterprise mix, information system components and data applications, summary measures of farm financial structure and performance, personal characteristics of farm managers, physical inventory of farm resources and production levels, and the manager's perception of farm risks.

To increase farmers' awareness of record keeping tools, educational programs to familiarize producers and agricultural professionals with IRM concepts and decision support tools will be developed. At the same time, gaps in tools available to support decision-making will be identified. New software that appears likely to facilitate IRM analysis and decision making will be evaluated, described in educational materials and added to workshops when appropriate. Educational materials will be modified over the three years of the project to reflect lessons learned through field experience and case study and simulation research.

Information exchanges will be conducted in two or more regions of each state. The forums will allow producers (or other targeted peer groups such as veterinarians) to share ideas and experiences concerning various aspects of integrated resource management. The one to two day information exchange will focus on three to five topics—for example, marketing alternatives, income diversification, waste disposal and environmental concerns, forage-grazing management, herd health practices—identified in advance using the Delphi approach with invited participants. The emphasis will be on producers (professionals) learning from each other and researchers learning from producers (professionals). Numbers of participants will be limited to allow maximum interaction and encourage open discussion. Educators will serve as moderators (not presenters) and will note concerns of the participants as well as innovative practices and ideas. Thus, the forums will suggest research and education needs and serve as a basis for future dialogue among beef producers, educators and researchers.

Educational programs and workshop offerings (county, multi-county, area) will include demonstrations of tools available for record keeping and analysis, "hands on" computer workshops featuring IRM decision support software, and discussion and examination of IRM practices as well as critical success factors gleaned from case study research. Workshops will also be offered to extension staff to provide them with the necessary resources to assist in IRM education. In addition, agricultural industry personnel (e.g., veterinarians, accountants and agricultural lenders) will be offered workshops to familiarize them with IRM educational programs and tools. Producers participating in the project, either as advisers or case studies, will be included in educational programs to

share their insights and provide testimonials.

Program materials to supplement existing IRM materials will be developed to enhance county, area and state extension staff IRM presentations and reach producers with information on IRM practices and tools. Examples include research reports, newsletters, extension fact sheets, slides with scripts for use by extension staff, producer information packets, brochures, and mobile displays for beef industry meetings and extension programs. Additionally, IRM information will be shared using the Internet through an IRM home page established at OSU. Educational materials will be shared with producers, extension staff, cattlemen's associations, agricultural organizations and academic colleagues in each of the three cooperating states and more broadly through industry associations and academic venues.

Initial interviews with producers serving as case studies are documenting existing management practices. A common research protocol will allow for comparison and contrast of production and financial management practices among cases in three states. Through the course of the study, changes in practices and the impacts on production and financial performance will be measured by project investigators and participants.

Extension staff and producers will be asked to rate the usefulness of different decision support tools, e.g. producers who have used SPA will being asked to evaluate its helpfulness. Evaluations will be conducted at producer meetings and the number of participants will also be recorded.

Results

The initial case study protocol has been drafted, pilot-tested and is now being revised. Case study participants have been identified in three states. Initial interviews are being scheduled. Once existing practices are documented, recommendations by the IRM team for changes on individual farms will be site specific, giving managers a guide to management priorities. Producers serving as case studies are expected to become better stewards of their resources and better equipped to survive financially.

Efforts are underway to document and/or evaluate existing materials which support IRM. A national survey of educators in several disciplines has been conducted to catalog IRM educational materials (publications, software, video) and a bibliography is being developed. A survey has been sent to cow/calf record software vendors to elicit responses regarding features and prices so that an updated publication can be developed. A cow/calf Standardized Performance Analysis (SPA) software user survey has been drafted.

One information exchange for cow/calf producers in the rolling plains of Texas has been held. Demand for "hands on" computer workshops on keeping farm financial records with Quicken is high. Educational materials are being updated for the latest release of Quicken.

Impact of Results

Expected outcomes of the project include greater adoption of IRM technological tools, improved on-farm information systems, and greater understanding of IRM concepts with increased feedback to researchers on high priority IRM needs. On-farm information systems form the foundation for effective decisions in sustainable farm operations. Maintaining and analyzing records, though not guaranteeing profitability, is expected to increase the producer's awareness of cause and effect relationships and sensitize them to the value of conserving resources.

Long-run sustainability of farms, whether small or beginning farms or commercial-sized family operations, is enhanced by better management practices. Knowing where to make management adjustments and modifications is difficult, particularly when the magnitude of expected impacts from a change is not known. Through this project, producers will have the opportunity to critically evaluate their operations using a holistic approach. Multi-disciplinary teams will assist in analyzing production and financial management practices as well as identifying opportunities for diversification. As research reports and extension educational materials are developed and delivered, farms in the region and in other states with similar types of beef production will also benefit. Although the focus of this project will be on farms with beef production, the model is transferrable to other types of production.

Potential Contribution

Ultimately, this project will promote the development of management skills and improved resource management practices, thus building human capital. Having well-informed IRM-oriented beef producers will strengthen the international competitiveness of the agricultural sector and contribute to a continued stable, low-cost and safe domestic food supply. Factors critical to successful integration of production and financial management and the sustainability of farms will be identified. This collective wisdom can then be shared with other farmers, educators and researchers, enhancing both the social and economic viability of family farms.

Plans for Remainder of Project

Once initial interviews are completed, secondary data collection and analysis will begin. Financial statements, a cow/calf standardized performance analysis, and forage assessment are expected to be completed. Stage two of the case study protocol will be discussed at the planning meeting in March. Events currently scheduled for 1997 include Quicken workshops in Oklahoma, Texas and at National Cattlemen's Beef Association annual convention; an information exchange for veterinarians at OSU, spring 1997; a SPA workshop in Texas, May; and training for accountants hosted by the Noble Foundation, June 1997. Other events will be added as plans further develop to achieve project objectives.

Cooperators continued

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Crop Management Systems for Improving Production of Culinary Herbs in the Virgin Islands

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In the Virgin Islands, herbs are prominent in the local cuisine, tempting the palates of visitors as well as residents who use them every day. But in the Virgin Islands, locally grown herbs are available only at roadside stands and do not constitute a significant V.I. export despite the perfect growing climate and the potential for significant income. A 1988 informal survey revealed that sales of herbs and spices are a major source of income for many small-scale growers in St. Thomas and St. Croix.

In spite of their economic importance there is little research information on sustainable crop management practices to improve production levels, processing and marketing of herbs and spices. There are few research information and extension recommendations on efficient and sustainable cropping practices for growing herbs in the Virgin Islands. Some growers are already utilizing low-input management practices such as the use of organic manures and composts, however, most are still producing herbs using high inputs of chemical fertilizers and pesticides.

Objectives

a) Develop sustainable soil management practices for culinary herb production using crop rotation with green manures, application of composts, animal manures and other organic fertilizers.

b) Evaluate sustainable weed management methods for culinary herbs using organic mulches, cover crops and biodegradable synthetic mulches.

c) Develop environmentally sound disease and pest management practices for herbs through cultural methods such as intercropping and crop rotation.

d) Increase fertilizer and water use efficiency in herb production by using microirrigation, thereby reducing fertilizer inputs and conserving water, a scarce resource in the Virgin Islands.

Approach

The development of sustainable crop management component technologies is the major activity of this project carried out in research/experiment station while the testing of component technologies which address major production constraints of growers is being accomplished in targeted farmers fields. All activities involve multi-agency, multidisciplinary and farmers' support and participation.

Under sustainable soil management practices, the project will conduct field experiments by growing popular herbs such as basil, thyme, chive, and parsley in rotation with tropical green manure crops such as sunnhemp, lablab or hyacinth bean, and cowpea. These green manures will be grown and residues incorporated into the soil the following season. Herbs will be grown after residues have been thoroughly decomposed in the soil. Soil samples are collected before the green manures are established and after complete decomposition prior to planting of herbs. Soils will be analyzed for organic matter and major nutrients. Likewise, biomass production will be measured from green manures to determine nutrient contribution to soil fertility. Separate trials will be carried out to compare efficiency and response of herbs to levels of compost and animal manure application. From these experiments, fresh yield of herbs will be determined based on multiple harvests as well as total production. Cost/benefit ratios will be estimated from growers yield data and the most profitable level of fertilizer or manure.

Organic and synthetic mulches will be evaluated for their effectiveness in controlling weeds in herbs. Field trials will be conducted to compare the effect of various mulching materials on weed population density and subsequent yield of herbs. Mulching materials include compost, dry grass straw, wood chips, shredded newspapers, black plastic and black fabric weed barrier. In addition to their effects on weed density and yield of herbs, the mulching materials will be compared as to their influence on soil temperature.

Growers have few options for controlling pests and diseases of herbs because there are limited number of insecticides or fungicides for herbs in the Virgin Islands. To develop environmentally sound disease and pest management practices for herbs, trials will be conducted focusing on cultural methods such as intercrop-

Project area
Cropping Systems

Project duration
June 1996-May 1999

Budget:

SARE	$143,529
ACE	
Matching	$62,420

ping and crop rotation. Herbs will be intercropped with insect-repellent plants known to reduce insect population and damage. Repellent plants can be either herbs or non-herbs planted in mixed cropping patterns or intercropping systems. Trials will be conducted to compare the effect of cropping pattern on population of targeted insect pests. Similarly, crop rotation study will be initiated in research station to investigate the potential of crop rotation in reducing disease incidence on herbs. Under this approach, two major activities will be carried out: 1) monitoring and describing insect pests and diseases associated in all trials previously described above, and 2) developing sustainable methods for controlling leaf miners and cutworms on basil and soilborne fungal disease on thyme. Through the assistance of an entomologist, pest population will be monitored on a weekly basis. Insect pests will be identified and described in terms of their occurrence, feeding habit and life cycles in associated herb species

Water is the most limiting resource for crop production in the Virgin Islands. Rainfall is not dependable and most of it is lost through evaporation. With scarce water resources, growers must therefore conserve water, yet the traditional practice of growing herbs involves watering by sprinkler cans and overhead sprinklers which are wasteful and inefficient. Cooperating herb growers will establish a trial to evaluate the efficiency of drip irrigation systems on herb production. These systems will be compared against their own system of watering herbs in terms of water use, efficiency and cost effectiveness. Trials will evaluate various levels of drip irrigation based on soil moisture content. The herbs will be irrigated to maintain various soil moisture contents below and above water holding capacity. From this study, minimum and optimum water needs of herbs will be determined including water use and cost efficiencies.

From these trials, data will be collected and analyzed for formulating extension recommendations on sustainable crop management systems for herb production in the Virgin Islands.

Since the project has just started in August and field trials were established in October, results will not be available until the end of this year (1996). Therefore, it is not possible to describe the impact of results on sustainable agriculture, but the prospect of culinary herb production for fresh, frozen, processed and dried products is bright and there is potential for production in the Virgin Islands to meet increasing local, regional and international demands. With tourism at the base of the modern Virgin Islands economy, local growers are developing ways to market culturally derived products that will reach and appeal to tourists and a more cosmopolitan population. The Virgin Islands is extremely popular tourist destination, hosting about two million tourists annually. It is predicted that attractively packaged, affordable local products like "bush teas" and pot herbs will appeal to many of the tourists. Other potential markets for culinary herbs are local restaurants, resort hotels and supermarkets. Expansion of herb and spice production through a greater understanding of production constraints and integration of appropriate sustainable management practices will economically benefit farmers, contribute to the viability of the local economy and satisfy consumer needs in the Caribbean and the U.S.

Plans for Remainder of Project

Plans for the remainder of this project are to concentrate on education and outreach. Useful research results and information generated from this project will be disseminated through a joint coordinated educational program between the UVI Agricultural Experiment Station, the Cooperative Extension Service and the Virgin Islands Department of Economic Development and Agriculture. This will be accomplished through farmer demonstrations, field days, farmers workshops and various publications.

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Integration of Pastured Poultry Production into the Farming Systems of Limited Resource Farmers

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Limited resource farmers in the USA need profitable farm enterprise alternatives to survive on the farm. In this project, Heifer Project International (HPI) in cooperation with numerous collaborators are giving limited resource farmers the opportunity to test a relatively new farm enterprise that is both economically and environmentally sound. That enterprise is pastured poultry. Pastured poultry is an endeavor in which broiler chickens (in this case) are raised on pasture in pens that are moved across the pasture daily. The chickens receive sunlight, fresh grass and fresh air everyday and are usually processed on the farm. No antibiotics are required in the feed. The system is healthy for the livestock, builds the soil with manure from the chickens, and provides the farmer with a decent return from this value added product.

Objectives

1.) Provide hands-on training in pastured poultry production, to 24 farm families who are currently members of farmer organizations that are supported by Heifer Project International. Training will include survey information generated on the success, impact and problems that 10 other farmers have experienced in pastured poultry production.

2.) Review and summarize federal and state laws regarding on-farm processing of poultry.

3.) Provide training in food safety and legal issues for the same twenty-four families and to assist them in complying with the laws in their state.

4.) Provide training in market development of farm products for the same farmers

5.) Help these 24 families conduct on-farm practical trials of pastured poultry and its integration with their other farm enterprises

6.) Include at least eight technical advisors (county extension agents or advisors from other local organizations) in the training program so they are prepared to support and encourage these families and others in the community

7.) Develop and implement monitoring systems that will provide useful information (income generation, pasture management, farm labor management, quality of life implications, farmer observations and problems) about integrating pastured poultry into a farming system

8.) Provide follow-up guidance and assistance to the families as they diversify their own production and marketing

9.) Aid in the development of the American Pastured Poultry Producer's Association (APPPA), which will serve these farmers and others around the country by providing a forum to share information and ideas related to pastured poultry.

Approach

Project activities began early in the year with some preliminary work necessary before chickens could actually be raised. Dr. Martha Noble with the National Center for Agricultural Law Research and Information (NCALRI) started a legal review of federal and state laws concerning on-farm processing of poultry. The states involved in the project and in the legal review were Kentucky, South Carolina, Alabama, Mississippi and Louisiana. Anne Fanatico with the National Center for Appropriate Technology's program known as ATTRA (Appropriate Technology Transfer for Rural Areas) surveyed 13 different pastured poultry producers around the country to gain insight from their experiences. Heifer Project International discussed the project with farmers in the organizations which HPI supports and recruited the families who wanted to participate. HPI, ATTRA, Southern University (SU), Kentucky State University (KSU) and Tuskegee University (TU) developed record books for the farmers to monitor their progress.

In addition, plans were made for a major training event lasting three and a half days at Polyface Farm in Swoope, Virginia. This is the farm of Joel and Teresa Salatin and family who originated the pastured poultry model. The Salatin family nets $20,000 per year by raising 8,000 pastured chickens during six months of the year. They have been following this model for over 10 years.

The training event, held in mid-June, was the kick-off activity for this project. Thirty-five people representing 11 farm families, three universities (SU, KSU and TU), the cooperative extension service from three states, Heifer

Project area

Livestock systems

Project duration

April 1996-December 1999

Budget:

SARE	$149,624
ACE	
Matching	$135,900

Project International's USA/Canada program staff, ATTRA, NCALRI, and other technical advisers, participated in this event which covered just about every aspect of pastured poultry imaginable. Participants built chicken pens, moved the pens, learned about brooding the chicks, processed nearly 500 chickens, received instruction in food safety and legal issues, learned marketing techniques, went over the required record books and worked from first light until past dark each day.

At the end of the session the farmers were given funds to do a small scale version of pastured poultry on their own farms. With the funds each farmer would build a pen, purchase 100 chicks, a feeder and a waterer. Upon receiving their checks, each farmer also signed a contract to "pass on the gift." Passing on the gift is a Heifer Project tradition in which everyone who receives a gift of animals becomes a donor. In this case each farmer who receives funds to start the poultry project is required to return to Heifer Project the purchase price of the chicks and to train another farmer in their area in the pastured poultry enterprise.

In signing the contract, the farmers also agreed to monitor their activities in record books provided to them. The record books included an expense and income log, a folder for receipts, a log to record total pounds of feed used, a daily calendar to record particular activities or occurrences, an information page on pasture management, a detailed labor summary, questions about the family's values and how this project could impact the quality of life for themselves and their community, and a page on farmer observations and problems.

Extension personnel, other technical advisers and HPI field staff all agreed to support these farmers as much as possible as they tested out their new enterprise.

In addition to farmer tests of pastured poultry, three universities also agreed to demonstrate the model on their farms. Southern University, Kentucky State University and Tuskegee University all participated in the training event and all agreed to try the system out on their own.

Several extra tools were provided to the farmers to make the process as simple as possible. A rough videotape of several of the training activities at the Salatin farm was made and sent to all farmers as well as a sample marketing flyer. A set of guidelines was developed to help the farmers properly carry out the project. The guidelines were particularly specific about chicken processing.

Results

Results, so far, have been very encouraging. Of eleven farm families who attended the training and agreed to participate, all eleven conducted their on-farm demonstrations. Although chick death loss has been higher than expected, farmers have done quite well. Marketing efforts have been quite successful overall. It seems that there is a market not only for the health conscious individual, but for rural people who "miss the way chickens used to taste." Five of the families have already gone on to do a second batch of chickens on their own and two of the families from one community have recruited two more families from their community to raise not only the broilers, but also laying hens. Only one of the families is not sure if they will do the enterprise again next year.

Presentations about the project have generated additional interest, as have two field days. Several other farmer groups have gotten very interested and one has already begun raising chickens. At the time of this writing, not all of the record books have been turned in and so complete data from this year's work is not yet available.

Impact of Results

Pastured poultry is a sustainable livestock production system that fits in quite readily with other enterprises that farmers often have established. It is good for the people, the land and the livestock. It encourages local food economies and puts more of the food dollar into the hands of farmers. It builds bridges between producers and consumers. It has the potential to keep many more family farmers on their farms.

Potential Contribution

Pastured poultry has great potential in the south. Consumers are becoming more interested in the quality of their food and limited resource farmers need sound agricultural enterprises that will fit into their current farming systems without putting them over their heads in debt. Pastured poultry fills this need. Farmers can stay at the small scale of operation that this project has helped them achieve or they can gradually move into greater levels of production and make pastured poultry a major aspect of their farm system.

In the final two years of this project many more families will be trained and given the opportunity to try pastured poultry. We expect to surpass our objective of 24 families.

With one year of experience behind us, we have learned a lot. Several good ideas came out of an evaluation of the project conducted in November of 1996 that will be incorporated into the future work. These include better ration formulation, new ideas for pen movement and regional training events to help the new farmers starting out.

Plans for Remainder of Project

Next year we expect the work of APPPA to be a larger focus and to be a helpful tool to those producing pastured poultry throughout the nation. There will also be increased activity at the universities next year. Early in the year a summary in lay terms of the legal issues involved with on-farm processing of poultry will be published by ATTRA. Such a summary has been needed for quite some time and will now be available for anyone living in the five states where this project is occurring.

At the end of the project in 1998, ATTRA will publish case studies of the farmers who participated in this event. This publication will be a tremendous asset to other farmers considering the enterprise in the future.

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Sustainable Agriculture Research and Education
Southern Region

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Sustainable Cropping Systems for Seedless Watermelon and Fall Lettuce in Rotation with Green Manures

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Objectives

The objectives include development of a sustainable crop rotation system for seedless watermelon and fall lettuce grown in rotation with green manure mixtures; exploring alternative markets for melons and lettuce; soil improvement, reduced fertilizer use and improved management practices for producers.

Approach

The research and demonstration are conducted on farmers' fields and experiment stations in North Carolina and Virginia. These sites represent different climates, soil types, marketing options and economic climates. The field studies have been initiated with fall planting of four cover crop treatments. Austrian winter peas, Hairy Vetch, rye, Austrian winter peas and rye, and Hairy Vetch and rye, and a non-planted control. In the spring, the cover crops will be mowed down. Two seedless watermelon varieties will be grown in each cover crop treatment.

After they are harvested, four lettuce varieties will be planted. Throughout the season, soil nutrients and pest populations will be monitored. The watermelons and lettuce will be test marketed in the regions in which they were grown. The expected outcomes will increase the income of producers of seedless watermelon and fall lettuce, cutdown the chemical input, reduce the nutrient losses, soil erosion, and improve quality of the groundwater, surface water and the environment.

The results will be disseminated through field days, farm tours, videos, brochures, flyers, fact sheets, technical papers and other published literature to farmers, end users, and others in North Carolina, Virginia, and neighboring states. Target audiences will include limited resource farmers, vegetable farmers, farmers looking for diversification, and farmers interested in sustainable agriculture. The research and demonstrations will be repeated during the second year.

Project area

Cropping systems

Project duration

April 96 - December 98

Budget:

SARE	$182,751
ACE	
Matching	$92,755

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Southern Region

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Saving the Southern Legacy: Heirloom Plants and Local Knowledge for Profitable, Sustainable Agriculture

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The aroma of old timey Plumgranny melons, the pattern of speckles on Moon & Stars watermelon, the flavor of broth from Blue Goose peas...these are some of the exceptional qualities of old timey varieties. Their quaint names have a familiar ring to long-time Southerners and raise the curiosity of newcomers. For today's farmers and gardeners who are accustomed to new, improved hybrids every season, these old varieties may seem to be mere curiosities, obsolete to modern, profitable agriculture. However, these long time favorites offer potential low cost, low maintenance, and high value, high interest crop options for Southern region producers working toward the goals of sustainable agriculture.

Unfortunately, the expertise and knowledge which these old varieties represent, while still extant, is seriously threatened, often vanishing at a more rapid pace than the plant varieties it evolved to sustain. The fear that these varieties will be lost forever has spurred many formalized seed exchanges to spring up across the country. The southern region's unique seed legacy has received less attention.

Through a broad-based collaborative effort, the Southern Seed Legacy Project (SSLP) strives to reverse the erosion of genetic variation *and* cultural knowledge in the South through research and education. The research component is focused on "memory banking," interviewing people across the southern states familiar with their local heirloom varieties in order to more fully document the associated knowledge and expertise. Also, SSLP is promoting on-farm and university-based research assessing genetic variability and adaptations of heirloom varieties to further our understanding of their use within sustainable agriculture production systems.

Objectives

1.) Network—Locate and link up individuals, communities, and organizations active in heirloom plant conservation in every state of the South. These will form the nodes of the Southern Seed Legacy Network.

2.) Document— Inventory the heirloom plant varieties culturally and historically relevant to peoples of the southern United States with special attention to rare or "at risk" varieties with declining availability.

3.) Record— Preserve the expertise and personal memories, knowledge of the people who these varieties through memory banking this information.

4.) Support— Enhance the capacity of farmers themselves to preserve, access, and exchange both the genetic material and relevant cultural information.

5.) Educate — Use the case of heirloom varieties in the South to reinforce the linkage between cultural diversity, biodiversity, and sustainable farming with educational outreach programs.

Approach

The SSLP Network serves as the focus of our outreach and education efforts. This communication and information network is being cumulatively built through the development of an extensive membership base. The Network is linked through the organizational efforts and distribution of publications originating out of the SSLP base office at the University of Georgia's Laboratory of Agricultural and Natural Resource Anthropology. Two key publications which faciliate communiction are *Seedlink*, SSLP's quarterly newsletter, and the SSLP Resource Directory (in progress). Five hundred surveys and the inaugural *Seedlink* newsletter are being distributed via mail and at relevant events which will add to SSLP's initial member list and raise interest in SSLP. *Seedlink* is a vehicle for reporting on and profiling seedsavers, heirloom varieties, research, institutions, and organizations having anything to do with heirlooms in the southern region. The resource directory, to be published in the projects second year, will compile the sum total of contacts—such as individual seedsavers, commercial heirloom growers, farmers' markets and festivals, research institutions, living history farms and demonstration gardens—our research this year will reveal.

SSLP's memory banking initiative involves recording any information about southern heirloom varieties, including local lore and reminiscences, from participating farmers and gardeners. This information is being collected in

Project area
Alternative crops

Project duration
August 1996- August 1998

Budget:

SARE	$152,817
ACE Matching	$103,971

field research with willing seedsavers from a range of ethnic traditions found in the South's different agricultural regions. A life history approach captures changes in varieties, technologies, and practices through time.

This oral testimony is being supplemented with visual materials, such as photographs and drawings of the varieties, videotapes of skills and practices, and maps of fields and gardens. Herbarium specimens and seeds of the heirloom varieties are being catalogued and cross referenced with interviews as well. All of this information will be archived at the University of Georgia in the Laboratory of Agricultural and Natural Resource Anthropology and the Ethnoecology/ Biodiversity Laboratory. Much of the memory banking information will be integrated in a computerized database. A more unconventional approach—the Memory Web—is also being developed for access on the World Wide Web. A multimedia web site will serve as another way to forge links between SSLP Network members, as well as make this information accessible to a wider audience.

Impact of results

Heirloom varieties may be thought of as having proven bundles of such traits, tailored uniquely to whole farm systems, including local soils, pests, day length, tastes, and other factors. Over the past 75 years, plant breeders have tapped these local materials by cross-breeding or transferring useful genes into modern hybrids valued in the south (e.g., corn, pecans, peas, beans, melons, okra, ornamentals, and many more). The value of even single genes to growers and consumers today in terms of resistance to pests and disease, tolerance to environmental stress, and post-harvest quality, is in the millions of dollars. Moreover, the unique nature of many heirlooms lend themselves to increased marketing potential such as innovative packaging and appealing to shifting consumer demands and interest.

Heirloom varieties contribute to sustainability by playing diverse roles in the whole farm system (e.g., production, marketing, consumption, and social reciprocity). Farmers save seed from year to year, reducing the annual expense of purchasing hybrids (most heirloom varieties are exchanged freely or with minimal fees to cover postage). They select for characteristics compatible with their specific farm environment and economic situation, thus reducing the dependence on such costly inputs as pesticides, irrigation, and seeds. Given their novelty appeal, in terms of flavor, appearance, and local history, heirlooms can be important to specialty markets, in demand for "authentic" regional cuisine.

SSLP operates on the premise that what is needed to enhance agricultural sustainability is a rediscovery of what has sustained southern farmers in the past, and an "echoing" of this knowledge across the entire region through education and outreach. As local varieties are selected over generations, so too is indigenous knowledge refined through experimentation. The reliance on inter- and mixed-cropping techniques and rotation of specific varieties before the introduction of monoculture with its high-cost energy subsidies must be understood and evaluated by a new generation searching for more sustainable forms of agriculture than those that modern varieties, fertilizers, and pesticides produced. Such farmer practices, evolved through a long process of co-evolution with their cropping systems, comprise a highly effective and low-input buffering system against economic, biological, and climatic fluctuations—a key to sustainability.

SSLP is anticipated to also serve as a means to bridge the generations, allowing the elderly to have a fruitful societal role in sustainable agriculture by passing on their knowledge to the next generation. By giving a voice to experienced senior citizens and recording their relationships with their seeds, crops, and the past agricultural landscape, lessons of past farming ecological mistakes can be re-learned for the future. Seeds, videos, and school memory banking projects can serve as vehicles for schools and community groups to learn first-hand the value of crop biodiversity and cultural diversity to sustainability and quality of life in their local settings.

Potential Contribution

The Southern Seed Legacy Project (SSLP) wants to be sure the culturally relevant varieties of the South's past will continue to bring nourishment, enjoyment, and environmental benefits to today's producers and consumers. Many of the people that are joining the SSLP Network are looking for old timey seeds they lost due to crop devastation by critters or weather and they want to replenish their seed stock for next year's planting. Other seekers remember certain varieties from their youth and they yearn for their taste again. And many of those who have been responding to SSLP are not homegardeners, but commercial producers who want to experiment with heirlooms, find out more information about them, or access larger quantities of heirloom seeds. Memory banking assures that fundamental and idiosyncratic information about southern heirloom varieties, such as folk names, descriptions, cultivation, post-harvest processing practices, is recorded while crediting the individuals, families, or communities who maintain and are knowledgable about these varieties. SSLP's systematic documentation and dissemination of this knowledge base will assure it continues to inform the evolution of sustainable practices today.

If producers begin to make a greater diversity of heirloom varieties available, consumers may enjoy rediscovering childhood favorites or trying out new varieties of favored crops. Some heirlooms serving as sources of local pride could be featured at food festivals and heritage tourism sites in rural areas throughout the South that want to retain their farming landscape and economic base.

Plans for Remainder of Project

SSLP is just beginning full-force. As a two-year funded project, we hope to accomplish short-term concrete outputs, such as publications, one-time workshops and events; as well as set in motion more long-term benefits, such as forging connections and raising producer and consumer awareness that will outlast the funded lifetime of this project. SSLP is also developing "seed heritage/memory banking" teaching kits for schools, and a "Memory Banking Methods" training manual to promote community-based conservation efforts. It is hoped that our efforts will ripple throughout the South where the young and the elderly can mutually explore their agricultural heritage through discussions of enduring southern seeds which have preferred qualities and still contain invaluable genes for profitability, resilience, palatibility, diversity, and thereby sustainability of southern farming.

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Multi-Cropping Cattle and Watermelon in the Southern Plains

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Cattle and watermelons are grown extensively throughout the southern United States. Production techniques and markets for both commodities are well established, but weather extremes, market fluctuations, and diseases or insects can be devastating to farmers that rely totally on one crop. Some farmers are involved in production of both commodities, but no one attempts to produce both crops on the same land in the same year. Farm diversification with cattle and watermelons would improve cash flow, minimize risks and lead to farm stability and sustainability.

The main disadvantage to cow-calf operations is that the income from small and medium sized cattle farms is not sufficient to maintain a desirable standard of living. Most farms in southeastern Oklahoma are 100 to 300 acres in size, and normally produce about $10,000 to $50,000 of gross farm income, with net profit being a fraction of the gross income. Thus, few cattle farms in southeastern Oklahoma are capable of supporting a family at a realistic standard of living.

Watermelons can produce gross returns in excess of $1000 per acre. While watermelons normally produce more income per acre than do cattle, much of the land planted to watermelon is subject to erosion when not kept under a plant cover. Watermelons should be grown in a given field no more than one out of four years to reduce the chance of soil-borne disease. Because of this, watermelon growers need access to at least four times the amount of their annual watermelon acreage. Pasture land is unlikely to have a watermelon disease problem, and is thus desirable as a site for rotation with watermelons. However, most cattle farmers are unwilling to convert a permanent pasture into watermelons, and then re-establish the pasture after melon harvest is completed.

In southeastern Oklahoma, most agriculture is in the form of cow-calf operations. Rainfall and temperatures are conducive to grass production, and markets are available throughout the year. Cattle production is also desirable from an environmental standpoint. Cultivated soils in the area are highly erodible by both wind and water, but permanent pastures keep vegetation on the soil and thus greatly reduce soil erosion. In Texas, watermelon producers can plant earlier and harvest later than can those in Oklahoma. This allows more flexibility in designing a multi-cropping system than could be done in Oklahoma.

The purpose of this project is to determine if watermelon and bermuda grass pastures can be grown in the same field in the same year. If such a system can be sucessfully designed and implemented, cattle producers could diversify their operations, minimize risk, and hopefully improve farm profits. Watermelon producers could reduce soil erosion and have a disease-free site for crop rotation.

Objective

Develop techniques for growing watermelon in tilled strips in a permanent pasture.

Methods

The study is being conducted in Oklahoma and Texas. The first part of the study was established in 1996. Experiments were established at university research stations to gather preliminary information about the value of various cultural management techniques for growing watermelon in strips in a permanent pasture.

Small scale replicated plots were established. In Oklahoma, the field did not have a vigorous stand of bermuda grass. In order to rejuvenate the grass stand, the field was sprigged with bermuda grass in the fall of 1995 and was also seeded with bermuda grass in the spring of 1996. In Texas, the field was already under a dense bermuda cover, so there was no attempt to improve the bermuda grass stand.

In the spring prior to treatment initiation, all plots were mowed. Strips 6 ft wide were tilled in preparation for the following treatments. In Oklahoma, the strips were on 18 ft centers, and plot length was 45 ft. In Texas the strips were on 30 ft centers, and plots were 35 feet long. The following treatments were then installed.

1. Mechanical cultivation was used as long as vine growth permitted.

2. Standard plastic mulch was installed in the center of the tilled strip. Approximately 3 ft of plastic was exposed after the edges were sealed.

3. Photodegradable mulch was installed in the same fashion as treatment 2.

4. Biodegradable mulch was installed in the same fashion as treatment 2.

Project area

Multiple land use

Project duration

July 1996 to Dec. 1998

Budget:

SARE	$54,752
ACE	
Matching	$49,600

5. Herbicide: Applications of sethoxydim (Poast) herbicide were made to control grass growth.

6. Mechanical Cultivation and Herbicide: This treatment consisted of cultivation as long as vine growth permitted. When vine growth restricted cultivation, Poast was applied.

7. Control treatment: This was a weedy check, where no weed control was attempted.

8. Clean control: Cultivation plus Poast plus hand-hoeing as needed.

In Oklahoma, watermelons in each plot were weighed. In addition, at harvest time, a line was stretched over each row of watermelons. At every one foot increment along the line, a determination was made of the material immediately beneath the one foot marker. The material at each marker was classified as grass, broadleaf weed, watermelon, or non-vegetative. Categories were then classified according to the particular type of grass or weed present, i.e. bermuda grass or crabgrass. After harvest, the amount of forage (primarily bermuda grass and crabgrass) was determined from randomly sampled areas within each row, and also from randomly sampled areas between the rows in each treatment plot.

In Texas, raccoons began to eat the fruit as it developed, making valid harvest data impossible to obtain. Therefore, a fruit count was taken. Fruit size was measured and grouped into categories of 0-10 inches long, 10-15 inches long, or 15-20 inches long. Rotted or partially eaten fruit which could not be identified by size were counted separately. Visual observations were taken of each plot after harvest, to determine the integrity of the plastic mulches and the amount of forage cover.

Results

In Oklahoma, the best treatments were in plots that were either covered with black plastic mulch or were maintained as a clean control. Each of these two treatments produced over six tons of watermelons per acre. The next best plots were those with photodegradable mulch, biodegradable mulch, or cultivation plus Poast. These treatments produced about three to four tons per acre. The remaining three treatments were unsatisfactory. The Poast alone and cultivation alone treatments produced about one ton per acre, while the weedy control produced less than 400 pounds per acre.

Overall, the black plastic mulch was one of the better treatments. At harvest, about 45 percent of each plastic mulch was covered with watermelon foliage, and about 42 percent of the area was covered with bermuda grass. However, in mid-November, 1996, the standard plastic mulch is still intact. It is likely that the mulch will have to be removed by hand before the next growing season. Much labor will be required to remove the mulch. The biodegradable and photodegradable mulches did not yield quite as much as the standard plastic mulch, but both are showing more degradation, and will probably not have to be removed by hand. It is unclear why the standard plastic mulch yield was higher than that of the other mulches.

In Oklahoma, 63 percent of the mechanical cultivation plot was covered with bermuda grass at harvest time. The weedy check plot had 74 percent bermuda grass cover. All three mulch plots had about 40 percent bermuda grass cover. The clean control had no bermuda grass, and the two plots containing Poast had less than 5 percent bermuda grass. The only other grass that was present in a measurable amount was crabgrass, which covered 12 percent of the mechanical cultivation plot, 9 percent of the weedy check plot, and 3 percent or less of the remaining plots. The primary broadleaf weed was pigweed, which was found primarily in the two plots treated with Poast. In these two plots, about 20 percent of the area was covered with pigweed, about 10 percent was covered with carpetweed, and about 10 to 20 percent was covered with other broadleaf weeds.

In Texas, based on fruit numbers, the best treatment was cultivation plus Poast, which produced over 500 melons per acre. The next best treatments were black plastic mulch, mechanical cultivation, biodegradable mulch, and Poast alone, which produced about 400 melons per acre. The weedy check plots produced about 100 melons per acre.

In Texas, the mechanical cultivation plot and the weedy check plot were both covered with bermuda grass. The grass was about 18" high and very thick. The standard plastic mulch was still intact in all plots. The biodegradable mulch was about 20 - 25 percent split, but was still present. The plot with Poast alone had about a 25 percent cover of grass and weeds. The plot with mechanical cultivation plus Poast was estimated to have only a 5 percent grass cover.

The treatment with mechanical cultivation and Poast produced the most melons in Texas, but had a relatively poor yield in Oklahoma. The field in Texas had a vigorous stand of bermuda grass but relatively few broadleaf weeds. In contrast, the field in Oklahoma had a less vigorous stand of bermuda grass, and the tilled row produced a thick stand of broadleaf weeds, particularly pigweed. Poast controlled the grasses within the plot area in both states, but the broadleaf weeds in Oklahoma were serious competitors with the watermelon.

Impact of Results

The preliminary information gained from this study has indicated that watermelons can be grown in bermuda grass strips. The yield from both states was acceptable, but was less than ideal. In each state, the watermelons were planted late in the season. In Oklahoma, the planting was intentionally delayed in order to have a vigorous stand of bermuda grass into which the melons would be planted. In Texas, a severe drought delayed melon planting. We are optimistic that yields in both states can be improved over those obtained in 1996.

Other than the relatively low yields, the project has produced good results. The low amount of bare soil present at harvest time is an indicator that soil erosion would be minimized with this production system. Similarly, the amount of soil covered by bermuda grass is a good indication that grass or hay can be produced on the same plots next spring.

Potential Contribution

The information gathered so far indicates that it will be possible for watermelon producers to grow melons in a field that has been in bermuda grass. The bermuda grass will not need to be eradicated from the field. In fact, one cutting of hay can be obtained before the watermelons are planted. Alternatively, the field could be grazed for approximately two months before the watermelons are planted, and could then be grazed after the melons are harvested.

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Alternative Agriculture Strategies for Rural Community Sustainable Development in Northhampton County, Virginia

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ODU

Fred Diem
Northampton Co. Coop.
Ext.

Cooperators continued on next page

Project area
Whole farm system

Project duration
Sept. 1996 to August 1999

Budget:

SARE	$228,517
ACE	
Matching	$97,658

Virginia's Eastern Shore is a narrow peninsula of land with prime agricultural soils lying between the Atlantic Ocean and the Chesapeake Bay. It has a long history of low-intensity human uses and stewardship of the land, water, and natural resources. Agriculture and seafood have historically been major components of the Eastern Shore's economy and culture.

This rural community now faces many of the socio-economic stresses typical of rural America. The Shore is distinguished from other rural communities by a substantial amount of grass-roots planning and recent sustainable development initiatives. These have laid a groundwork for economic vitality based on traditional industries and rural quality of life, while protecting and enhancing the globally significant natural resources.

Farmers on the Eastern Shore know they cannot sustain family farms alone on the marginal yields and profits from commodity crops such as grain and soybeans. Farmers must feel they have economically viable options through crop diversification and use of sustainable production strategies. Widespread adoption of such strategies, however, will require more than mere farm management. Addressing new marketing opportunities, value-added marketing, or reducing risk through diversification will be required to produce that vital additional profit margin.

Sustainable production of new crops or new uses for current crops grown sustainably, coupled with value-added processing and regional marketing emphasizing the Eastern Shore's unique history and natural treasures offers an economically and ecologically viable option for the survival of the historically family-owned Eastern Shore farm. This project uses coordinated research and demonstration plots to explore options for lower input and alternative crops linked to value-added marketing. Successful production of value-added agricultural products will create economic conditions that foster locally owned businesses and employment opportunities for sustainable development in a rural community.

This three year project will explore the barriers to and benefits from alternative agriculture strategies on the Eastern Shore of Virginia. The project will assist growers in identifying economically and environmentally sound management strategies and improved marketing opportunities for the resulting crops and products.

Objectives

1). Establish communication network which explores and shares the benefits from and perceived barriers to adopting sustainable agriculture with growers on the Shore, reaching beyond the agricultural community to include other sustainable development and marketing efforts.

2). Identify and evaluate agricultural and economic opportunities including adaptation of sustainable techniques, identification of constraints, development of risk analysis, and evaluation of market strength and potential.

3). Facilitate implementation of on-farm demonstration sites using alternative technology or crops.

4). Conduct research, analysis and feasibility studies to assist farmers in transition to alternative crops and/or technology and the production of value-added products.

5). Evaluate the success of this project by monitoring a) the farmers attitudes and perceptions of agricultural, environmental and quality of life issues and b) the local citizens' perceptions of sustainable agriculture's role in this rural community's vision.

Approach

The participating growers are supported by an interdisciplinary technical team with expertise in extension service, sustainable agricultural production, niche crop experience, economic feasibility assessment, market development, sustainable community development, and social, economic and ecological impact monitoring. The technical team will provide on-farm grower consultation, ensuring timely sharing between participating growers and with other interested growers on the Shore.

In the 1997 growing season, participating growers will use alternative technology or produce alternative crops on demonstration plots,

within the context of their whole farm strategy and business plan.

Working with the technical team, growers are selecting crops to be investigated further. The technical team is conducting production research and economic evaluation for these identified crops. Growers are preparing demonstration sites with cover crops for the 1997 growing season. Qualifying agricultural products will be marketed by Virginia Eastern Shore Corporation while arrangements will be made to assist in the marketing of other demonstration plot products. Growers are conducting one-on-one planning with the technical team for their whole-farm and business plans. Initial outreach and data collection beyond the participating growers will begin through the January 1997 Eastern Shore Agriculture Conference.

Grower managed on-farm demonstration plots, site-specific sustainable production research, concurrent economic risk analysis and market feasibility determination, and rural community development to strengthen the role of the family farm are all critical components of this project.

In addition to demonstration site field days, outreach will include sponsored workshops, field trips, and public forums, as well as existing farmer conferences and extension programs. To facilitate broader, local community outreach the concept of an annual "Farm Festival" is being pursued. This festival will help improve farmer-neighbor relationships and generate a demand for local agricultural products through consumer education about value-added products.

Participating growers will evaluate the selected sustainable agricultural enterprises. Critical factors affecting the ability of growers on the Shore to market alternative products will undoubtedly include the volume, form and supply time frame for these Eastern Shore products.

Participating growers are providing base-line information about their concerns and expectations from the project and visions for their farm operations and rural community after implementation. With grower input, the project is developing a survey and interview tool to measure attitudes and perceptions of the barriers to adopting sustainable agriculture on Shore. Follow-up data collection will measure any changes in attitudes and perceptions about these issues as a result of participating in this three year grant project.

Potential Contribution

Sustainable agriculture and local communities can support each other through purchase of local products and services. Value-added activities can produce returns to the local community which offset reduced input purchases typical of sustainable farms. Sustainable agricultural practices which involve better environmental management strategies would also improve the community's perception of the impact of agriculture. Community awareness will help generate support for and promote locally owned, value-added sustainable agriculture enterprises.

The Northampton County's Sustainable Development Action Strategy's "Agriculture Industry Task Force" has as its goal the "return of local agriculture to its historic economic level in a manner which sustains the industry at its full economic potential and maintains productive locally owned farms for the on-going benefit of all citizens and future generations." This Task Force is actively participating and providing guidance for planning and implementation of this project.

Plans for Remainder of Project

The project will be moving from the planning and development stage to the implementation and evaluation stage during the 1997 growing season. This grant is seen as just a first step to explore the barriers to and benefits from alternative agriculture on the Eastern Shore of Virginia. This grant begins an open-ended inquiry, providing an opportunity to consider a wide range of possibilities and ask "what if..." questions to facilitate positive change in this rural community.

The intent of this project is to assist Eastern Shore farmers in the transition to sustainable agriculture by using sustainable technologies and growing alternative crops on a small scale.

Cooperators continued:

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Marketing

Tom Harris
Tim Hayes
Northampton County

Art Carter and James Kellam
Barbara and Phil Custis
J.W. (Butch) Nottingham
Barbara and Marshall Schwenk
Phylis Smith
Parnell Stachell
John E. Tankard Jr.
K.S. (Pete) Terry
Greg Turner
All Farmers

SARE
Sustainable Agriculture Research and Education
Southern Region

AS92-2
Final Report
December1996

Habitat Enhancement for Beneficial Insects in Vegetable and Fruit Farming Systems

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Objectives

1.) Screen selected plant species, including cover crops, for attractiveness and habitat value to predators and parasitoids of key pests of cabbage and squash;

2.) Develop production systems for cabbage and squash using habitats altered to favor natural enemies of their insect pests;

3.) Evaluate these agroecosystems, including economic comparisons with monocropped systems.

Approach

Ten vegetable growers in Arkansas and Oklahoma, and three university professors whose responsibilities included both research and extension were involved in project design, on-farm and research center trials, evaluation and information sharing. Two of the Arkansas farms belonged to and provided educational demonstrations for nonprofit organizations. The other eight farms ranged in size form 12 acres to 220 acres, with 1/2 to 4 acres in vegetable production. All farmers grow a variety of vegetables, fruits, and flowers for local markets.

Plants were chosen for screening based on reports from similar trials and the experiences of participants. Native and non-native flowers planted in screening plots included *Monarda citriodora, Ami magus, Cosmos bipinattus, Achillea millefolium, Asclepiad tuberoses, Lustrous pychnostachya, Gaillardia sap., Rudbeckia hairdo, Solidago sap.,* and *Coreopsis sap.* Herbs included bronze fennel, basil, cilantro, dill, and borage. Winter cover crops included crimson clover, hairy vetch, subterranean clover, white clover, alfalfa and rye. Records were kept on cultural activities, blooming period and insect activity. Researchers vacuumed insects off the plants and stored them for lab identification.

Results

Plants noted by many farms as being highly attractive to beneficial insects included basil, cilantro, dill (and all flowering plants in the umbel family), arrow, buckwheat and crimson clover. Other flowers noted by one to two farmers as highly attractive were anise hyssop, garlic chives, mints, goldenrod, asters and other native plants in the composite family, and a commercial mix that contained radishes.

Participants evaluated several strategies for incorporating habitat enhancing plants into cropping systems: companion planting, strip planting, and border or island planting. To evaluate the systems, cabbage was grown with and without habitat enhancing plants. The ratings were as follows:

Companion planting - a mix of different species of plants within a row or bed - was rated as difficult to manage due to varying cultural needs of species i.e. planting time, harvest time and methods of planting and harvesting.

Strip planting - alternate rows or beds of habitat plants and vegetables - were rated as most easily adapted to vegetable production systems. Farmers and researchers also managed cover crops as strips, tilling or mowing to kill winter cover crops before planting cabbage in the strips.

Border planting - fence rows, field edges, or islands of "habitat" plants - were also rated as reasonably adaptable.

In all systems, cooperators agreed that diversity is desirable. Plant species that bloom at different times of the year provide a more consistent supply of pollen or nectar. Cooperators also agreed that habitat plants should have additional value to the farmer as cut flowers, herbs, green manures or forages.

Farmers cited interaction with other farmers, learning new things, and contributing to knowledge about sustainable agriculture as important benefits from this project. Workshops with project researchers covering insect collection and identification facilitated information exchange between farmers and researchers. From planning sessions through year-end evaluation, all participants worked together as equals. On-farm field days hosted by the participants reached out to the larger community. All farmers stated that they have changed their farming practices and/or the way they view insect and crop interactions, as a result of this project. They continue to share what they learned with other farmers and with people who buy their produce.

Research results from Alabama indicated sig-

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Edwin Kessler
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Bob & Norma Constien
Megan Hughes

Milton Cowan
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Development Corporation

Project area
Beneficial insects

Project duration
Feb. 1992-Jan. 1995

Budget:

SARE	
ACE	$149,039
Matching	$72,261

nificantly lower numbers of diamondback moth larvae when cabbage was planted in strips between a fall-established planting of legumes as compared to cabbage planted in clean-tilled plots. White clover was superior to alfalfa, subterranean clover, crimson clover, and common vetch in terms of lowest cabbage damage rating.

SARE
Sustainable Agriculture Research and Education
Southern Region

AS93-8
LS94-64
Annual Report
December1996

Development of Suitable Area-Wide Weed Management Practices for Improved Land Utilization

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Objectives

Musk thistle, an introduced plant, is a noxious weed that impacts land utilization over a broad geographical region. This weed grows in many areas that are inaccessible and uneconomical for herbicide use or mowing. A project to develop and integrate a sustainable weed management program incorporating the release and establishment of two introduced thistle-feeding biological control agents was initiated with cooperators from Georgia, North Carolina, Tennessee, and Virginia. This multi-disciplinary (entomology, agronomy, and agricultural economics), multi-institution/agency (North Carolina Department of Agriculture, Tennessee Department of Agriculture, Tennessee Department of Transportation, University of Georgia, The University of Tennessee, and Virginia Polytechnic Institute and State University), and multistate (Georgia, North Carolina, Tennessee, and Virginia) project involves research and extension entomologists, agronomists, agricultural economists, numerous grower and state organizations, and farmers.

This regional project emphasizes farmer education and the functional integration of research technology for implementation of sustainable management of musk thistle into ongoing farm systems. The overall goal of this project is to develop and integrate a sustainable weed management program that incorporates the release and establishment of two introduced thistle-feeding biological control agents. These two agents feed specifically on thistle and pose no threat to agricultural crops.

These biological control agents have been evaluated, and are established, in Virginia, where they effectively provide sustainable control of musk thistle. Research knowledge from previous studies in Virginia will be transferred and developed into a practical, integrated sustainable management program for surrounding states. Once developed, this program can be easily adapted by personnel in other states for sustainable management of musk thistle. The specific objectives of this proposal are to:

1.) Establish and maintain on-farm field insectaries in Georgia, North Carolina, Tennessee, and Virginia for propagation of two introduced thistle-feeding biological control agents.

2.) Develop a distribution plan to provide biological control agents to landowners and agencies for release in thistle-infested areas.

3.) Develop and implement a regional educational program (through grower education days, field days, county meetings, publications, etc.) to improve public awareness of sustainable management systems using this program as a model. The educational program will be directed at numerous targets including farmers, landowners, schools, organizations, and state and federal agencies.

4.) Assess the economic and environmental benefits of this type of sustainable weed management program.

Approach

During the second year of this project, about 44,000 biological control agents (i.e., two types of plant-feeding weevils) were released against musk thistle at locations in Georgia, North Carolina, Tennessee, and Virginia. About 4,400 head weevils, *Rhinocyllus conicus,* and 10,150 rosette weevils, *Trichosirocalus horridus*, were collected and redistributed on thistle-infested farmland in Tennessee. Approximately 1,160 head weevils were collected in Tennessee and provided to cooperators for release on farmland in North Carolina. During 1996, 2,450 head weevils were collected in Virginia and released in Tennessee (1,200) and Virginia (1,250); 6,900 rosette weevils were collected in Virginia, and provided to cooperators in Illinois (600) and Virginia (6,300). Head weevils (ca. 2,000) and rosette weevils (1,000) were redistributed in North Carolina; head weevils (ca. 9,500) were redistributed in Georgia. In 1996, weevils were released at about 25 sites in 7 counties in Georgia, in four counties in North Carolina, at 80 sites in 13 counties in Tennessee, and at several sites in four to five counties in Virginia. On-farm and off-farm demonstration sites and field insectaries were established and maintained in Georgia, North Carolina, and Tennessee. Two field insectaries also were maintained in Virginia for propagation of biological control agents.

Project area
Weed management

Project duration
March 1993- Dec. 1997

Budget:

SARE	$3,760
ACE	$161,240
Matching	$133,000

During 1996, this regional project was outlined and discussed with numerous county extension agents and farmers, as well as at various grower meetings, field days, and scientific meetings. Because this program is relatively new to Georgia, North Carolina, and Tennessee, much continued effort was placed on contacting and explaining this project to county agents. Additional cooperators were aligned and field insectaries were designated. Information on this sustainable weed management program was distributed through various media outlets (e.g., letters, publications, grower meetings, field days, television reports, and professional meetings).

As part of the educational component of this project, "Weevil Roundups/Rodeos" were held in several counties in Georgia and in Tennessee. These activities, held on grower cooperator farms, were developed in cooperation with county agents. Farmers, other interested individuals, and several extension agents from other counties attended these field demonstrations. Participants received "hands-on" experience related to weevil identification, as well as identification of the types of damage caused by these biological control agents and a general overview of this sustainable program. The goals of this project were outlined, and questions were answered. At the conclusion of the program, participants received and/or could collect weevils to redistribute into other thistle-infested areas.

This environmentally safe and economically sound management program is expected to provide environmental, economical and social benefits. These include reduced herbicide use, improved pasture management, improved water quality, improved land value, reduced fossil fuel and labor costs, reduced impact on non-target organisms, reduced risk of exposure to herbicides, reduced herbicide residues, and reduced costs of weed management (e.g., in Missouri and Virginia, management agencies and farmers save from $750,000 to $1,000,000 annually in reduced herbicide use compared to previous conventional practices).

Reducing musk thistle populations to lower levels will eventually lead to an increase in available pasture and crop lands. Valuable efforts expended to control musk thistle could be allocated more effectively and efficiently on crop or livestock production. Establishment of this biological control system should provide a self-perpetuating, sustainable control system capable of being implemented over wide areas. This project should also reduce environmental pollutants, thereby protecting the environment and natural resources. Management of weeds, such as musk thistle, using sustainable systems will demonstrate a positive approach to the current global concerns over environmental and groundwater contamination by pesticides.

Results

Once established, these biological control agents can significantly impact populations of musk thistle. For example, densities of musk thistle have decreased dramatically (ca. 97 percent) in Tennessee since 1989 when initial large-scale releases were initiated. Similar reductions have now been observed at one site (70.7 percent reduction) in North Carolina and at five sites in Georgia. In some areas in Tennessee, densities of musk thistle were too low to enable collections of head and rosette weevils. These low populations of musk thistle are a direct result of the impact of these biological control agents, which are well established in eastern Tennessee and efforts are underway to enhance their establishment and distribution in middle Tennessee. The average number of seeds produced per plant also has been reduced by these plant-feeding weevils. As the number of seeds decline, the available seed bank in the soil should also decline.

Data suggest that the number of musk thistle plants and the number of seeds available in the soil are decreasing as a result of this project. As plant populations decline, fewer monumental efforts will need to be initiated to manage musk thistle over a large area. This decline in musk thistle should result in economical and environmental savings to farmers and other landowners. For example, Tennessee Department of Transportation estimated that they saved about $1to $2 million as a direct result of this project. The economic savings to farmers also should be high. A survey is planned to evaluate the economic savings to growers in Tennessee. These plant reductions also should enable farmers and other land managers to better utilize their land. Future efforts will continue to focus on the redistribution of both species and on the education of growers and the public on integrated management of thistle weeds using biological control.

Impact of Results

These two biological control agents contribute to sustainable control of musk and other exotic thistle pests. Using these two thistle-feeding weevils, farmers and landowners can control thistles in a nontoxic, nonpolluting manner that is sustainable. In addition, once established, the control agents disperse to attack thistles in adjoining areas. In many locales, such as the mountains, farmers cannot get equipment into their fields or they cannot afford to mow or spray thistles. This biological control program gives these farmers thistle control in the areas that may need it most.

Potential Contribution

This program should demonstrate the effectiveness, ease of adoption and incorporation, and economic and environmental benefits of an integrated biological control program for successful area-wide sustainable management of musk thistle. This program should also contribute to education of farmers and the general public as to the benefits of sustainable biological control programs. The success and educational benefits of this program should encourage more use of biologically sustainable programs in other states.

SARE
Sustainable Agriculture Research and Education
Southern Region

AS93-9
LS93-56
Annual Report
December1996

Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production

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Objectives

The overall objective is to develop a system to manage a native nonpest soldier fly larvae (SFL) to; (1) reduce manure accumulations where livestock is housed, (2) eliminate house flies and (3) produce tonnage of high quality feedstuff. Currently this system is being developed for caged layer houses and specific objectives are:

1.) Determine depth of manure basin necessary to allow SFL to utilize manure accumulated during the previous winter.

2.) Characterize plant nutrients in layer manure with and without SFL.

3.) Evaluate manure volume reduction, esp. of winter accumulation.

4.) Evaluate SFL feedstuff production, quality and utilization.

5.) Determine feasibility of using this system in high-rise layer houses.

The black soldier fly (*Hermetia illucens*) occurs worldwide in the tropics and temperate regions. The larvae of this large, wasp-like fly occur in very dense populations on various organic wastes and excludes other flies. We are developing a manure management system for caged layers using soldier fly larvae (SFL). In our system, wild populations of SFL are managed in concrete basins under the hens (could be hogs or cattle) to:

1.) Eliminate house fly breeding.

2.) Eliminate half of the manure through incorporation into larval biomass.

3.) Produce large quantities of high quality feedstuff (42 percent protein, 35 percent fat) through *self-harvest* of prepupae (ca. 65 tons/ 100,000 layers annually). SFL convert manure to "meat" about as well as hogs convert their feed.

This system will greatly reduce manure handling and pollution potential and increase feedstuff production. This contribution of high quality feedstuff could be a huge benefit to the livestock industry, especially if world menhaden (fish meal) stocks continue to decline. Twenty-three thousand tons of dried larval feedstuff with a minimal value of $7 million could be produced in the Georgia layer industry each year. If adapted to broilers and swine, over a larger geographic area this would be multiplied many times. Environmental benefits may be more valuable than direct economic returns.

Utilization of the larval feedstuff has been extensively studied. It has been successfully incorporated into the diets of poultry, fish and swine with hogs actually preferring a larvae based diet over a soybean diet. One of the most remarkable things about this system is that the larvae self-collect themselves. They do this as they are leaving the manure basin to transform into the adult. At this stage they are at their maximum size, with a large store of fat. This fat is to sustain them to adulthood, but is a valuable feedstuff. This stage does not feed. Considering their diet, this is a definite plus.

Approach

The 24-by-60-foot experimental caged layer house was completed and 1700 layers were installed in September 1994. About 41,000 SFL were released into the outer two pits (there are four pits) where they were managed. The inner two pits were sprayed with Larvadex® to eliminate any larval activity. Soldier fly activity had almost stopped when hens were installed in late September. The larvae that were released overwintered in the general area, emerged as adults in April and laid their eggs.

One main objective was to determine if SFL could digest the stockpiled, winter-accumulated manure. If this was successful it would have almost doubled the benefits of manure reduction and feedstuff production. In previous studies SFL had been successfully used to manage manure as it was produced in the warmer months of April to October.

Results

Unfortunately the deep, dry base of older manure caused two problems in 1995; failure of prepupae to exit the pit to self-harvest and a darkling beetle outbreak. Also, there was a house fly outbreak in the fall just after hens were introduced. None of these problems had occurred in previous studies with a spring manure clean-out and an established SFL population in-place through the fall and winter.

The commercial scale manure basin was ef-

Project area
Manure management

Project duration
Sept. 1993-Dec. 1997

Budget:

SARE	$2,150
ACE	$49,100
Matching	$25,626

fective in harvesting the prepupae that did attempt to exit, and manure clean-out was routine with a small Kobuto tractor with front-end loader.

In 1996, returning wild female soldier flies established a robust larval population soon after hens were installed on April 29. An ovipositing female survey at this house (one time count in the early afternoon) indicated an average of 52 present and ovipositing on each of 29 counts from May 7 to August 20. Assuming a residence time of 15 minutes (true residence time unknown) and an active oviposition period of five hours, then 1040 females would oviposit daily.

Given an average mass size of 998 eggs, then over a million eggs would be laid daily to digest the manure of the 1900 hens. Given a residence time of two months per larvae, a population of about 60 million would develop. All of this oviposition is from a wild population residing around the manure management facility. House flies were controlled, and no lesser mealworms developed in pits where soldier fly larvae were allowed to establish.

Analysis indicated that plant nutrient amounts were about the same in manure digested by soldier fly larvae as in undigested manure. The four-foot-high, 40-degree ramp for prepupae self-harvest did not allow the same rate of collection as previous designs. This flaw was not evident in the low collections of 1995.

There are three problems: 1) height is excessive–two and a half feet would be sufficient, 2) 40-degree angle is marginal. It should be less, and 3) rough texture on ramp was a mistake. It should be smooth so climbing prepupae do not turn over and roll back down the ramp. These problems are easily remedied and the design will be changed for 1997.

Bull frog experiment

Bull frogs were reared on a diet of self-collected live soldier fly prepupae and catfish pellets in a system patterned after commercial frog production in Latin America. In the Latin American system, house flies are cultured at some expense on dairy by-products. By using soldier fly larvae, our live feed is a by-product of manure management. This is our second year raising frogs from tadpole to adult on this diet. Dr. Larry Newton has been the lead in this research. Below is a data summary comparing our rearing to that of a Mexican frog-culturist:

	Newton & Sheppard	Rodriguez-Serna
Av. final wt.	48 gm (90d)	112 gm (175d)
Av. gain/day	.227 g (90d)	.298 g 56 days .626 g 175 days
Feed dry matter/gain	3.38	2.55 (56d) 3.79 (175d)
Feeding rate (to body weight on dry matter basis)	2%/day	8.6% begin 3.6% ending/day

Given our low feeding rate, general lack of experience in this area, and use of a wild strain of frog, these results seem encouraging. Use of a strain of frog adapted to captivity would probably enhance growth greatly. Also, we only fed three days a week.

Greenhouse experiment

Soldier flies were colonized briefly in a greenhouse. Two thousand prepupae were placed on August 30 and the first emerged adult was seen September 9. First chasing (males after females) and mating was seen on September 13. On September 15 a female was seen in the media bucket with ovipositor extended, but no eggs were found. First eggs were deposited September 16 (these were fertile). Twenty-five egg masses were collected on September 17; also much chasing and mating on September 17. Forty-seven egg masses were collected on September 19. Adults were never seen to feed, but did go to cool-cells (wet cooling pads) to get water. Pig weed that had volunteered on the greenhouse floor was a favorite resting site. Maximum numbers of adults ever present was estimated to be 75 on Sept. 16. This dwindled to four on October 1. Soldier flies exhibit a very extended and variable time to emerge and a few adults continued to appear into February. Mass culturing for initiating new populations for waste management seems feasible.

Plans for remainder of project

In 1997, new collection ramps will be installed that are lower and smoother to optimize prepupal collections. No pits will be treated with larvicide since these pits seemed to be acting as an "egg sink"; attracting ovipositing females, but producing no larvae. Bull frog production may be continued. We are attempting to work with a commercial producer to construct a high-rise caged layer house using this soldier fly manure management system.

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Sustainable Agriculture Research and Education
Southern Region

AS93-10
LS91-39
Final Report
December1996

Poultry Litter as a Soil Amendment in Southern Row Crops: A Feasibility Study Based on Agronomic, Environmental and Economic Factors

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David Johnson
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Project area
Waste utilization

Project duration
March 1993-Dec.1994

Budget:

SARE	$300,000
ACE	$100,000
Matching	$64,043

Poultry production in the U.S. is concentrated in the southeastern states. In this region, poultry are produced very efficiently by growing large numbers of birds in relatively small areas. However, this concentrated type of animal agriculture also results in the production of large quantities of poultry manure that must be disposed of in a way that does not harm the environment. This is becoming more and more difficult to do, because there is only so much land in the vicinity of the poultry houses on which to spread the manure, and levels of potential pollutants such as phosphorus are getting dangerously high in this land.

Poultry litter, a mixture of manure and a bedding material such as sawdust, could be a valuable fertilizer material for traditional southeastern row crops such as cotton, corn and soybeans, but the poultry producing areas are generally a long ways away from areas where row crops are grown. Despite this, it appeared that there might at least be some scenarios in which it would make economic sense to haul litter from the poultry producing areas, where it was rapidly becoming a problem, to millions of acres of soils used for row crop production.

The objective of our study was to assess the economic feasibility of transporting litter from poultry producing areas to row crop areas in two representative southeastern states, Arkansas and Alabama. To do this, it was necessary to study how row crops responded to litter applications on a variety of soils. It was also important to determine whether or not poultry litter could be applied to the soil in row crop areas in such a way that it would not be harmful to the environment.

Objectives

1.) Quantify both the short-term and long-term agronomic value of poultry litter.

2.) Document the environmental consequences of land application of poultry litter in the row crop regions.

3.) Using the agronomic data on yield responses, estimate the farm level derived demand for poultry litter and poultry litter compost as a soil amendment; integrate the derived demands with costs of acquisition, transportation and application to determine the market feasibility of litter transport from areas of concentrated poultry production.

Approach

Our experiments consisted of applying two different forms of poultry litter, fresh and composted, to a variety of soils at several different rates, growing crops on the litter amended soils, and then measuring crop yields and selected soil and water parameters indicative of environmental quality. These data were then used to predict the scenarios in which litter could be economically transported from poultry producing areas to row crop areas. Crops grown in Arkansas were soybean and winter wheat. Some of the environmental indicator variables which were measured were nitrate leaching, soil pH and salinity, and floodwater concentrations of phosphorus and other elements (rice only).

Results

The results of these experiments showed that, when applied on an equivalent nitrogen basis, poultry litter was as good a source of nitrogen as inorganic fertilizers such as urea or ammonium nitrate. From an agronomic point of view this means litter was usually as good as the commercial fertilizers.

An exception to this general rule was observed on plots that had lost much of their topsoil as a result of either erosion or land forming. On these soils, litter usually outperformed the commercial fertilizers. While we are not absolutely sure why this happened, it is consistent with the results of similar experiments by other researchers and is most likely due to the fact that poultry litter is a more complete fertilizer, i.e., it contains small but measurable amounts of many plant-essential nutrients in addition to significant quantities of nitrogen, phosphorus and potassium.

Litter seldom outperformed commercial fertilizers on plots that still had most of their original topsoil. The results also showed that there is little or no difference between the fertilizer value of fresh and composted litter. Spring applications of litter were shown to be more effective than applications the previous fall. Beneficial effects from a single, large, previous-year application were observed, but multi-year appli-

cations at lower rates produced greater yield of rice and cotton.

Impact of Results

Overall, there were no serious environmental consequences of applying litter to the row crop soils in our study. There were no indications of salt accumulation in soils receiving litter, nor were there any long-term changes in soil pH associated with use of litter. In the more poorly drained Arkansas soils, there was no evidence of nitrate leaching, but there was evidence of nitrate leaching from soil fertilized with high rates of litter in Alabama. This leaching could largely be controlled by planting a winter cover crop on these soils.

Not surprisingly, it was found that whether or not it was economically feasible to use poultry litter as a fertilizer in the row crop regions depended on several variables. The most important of these variables were cost of litter compared to commercial fertilizers, transportation costs, the magnitude of the difference between crop yields produced by litter application compared to commercial fertilizer application, and crop prices. The results of the economic analysis suggest that there is significant derived demand for poultry litter and poultry litter compost as soil amendments. The use of fresh poultry litter can be profitable for rice, cotton and soybeans in some years when litter can be obtained at a price of $45 per ton or less. Given the fact that fresh litter is generally available for $5 to $47 per ton in the poultry producing areas, a market should exist for locations where the total transportation costs are $40 per ton or less. In pairwise comparisons with fresh litter, the general trend observed was that, at a lower cost fresh litter outperformed the poultry litter compost.

Potential Contribution

The greatest potential market for both fresh and composted poultry litter appears to be as an amendment for degraded soils, particularly those whose productivity has been seriously impaired as a result of either erosion (more common in Alabama) or land forming (leveling) operations (more common in Arkansas). Application of poultry litter to degraded soils often resulted in significantly higher yield than those obtained through the application of inorganic fertilizers. The higher derived demand that this created for the litter would allow the litter to be used profitably even when its total price exceeded $45 per ton.

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AS93-11
AS94-11.1
Annual Report
December1996

Use of Poultry Litter or Manure for Root-Knot Nematode Management on Vegetables and Field Crops

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Objectives

Poultry is a large agricultural industry in the southeastern United States. The poultry industry generated an estimated income of $480 million in South Carolina and $1.5 billion in Georgia during 1995. In addition to providing income and food products, the industry generated an estimated 3 million tons of waste in South Carolina and Georgia during 1995. Although poultry is a significant economic component of agricultural income in the southeastern United States, it also presents a significant challenge to manage and utilize the waste that is generated. Poultry manure contains significant quantities of fertilizer [Nitrogen (N), Potassium (K) and phosphorus (P) and micronutrients]. Application of litter or manure to land has been viewed as a substitute for mineral fertilizers and as a method for disposing of unwanted waste. The N, P and K components in the manure are equivalent to an estimated $61 million of inorganic fertilizer.

Root–knot nematodes, a debilitating plant root parasite, are common in southern soils and are a serious problem on vegetable and field crops. On just two row crops in South Carolina (cotton and tobacco) an estimated $10 million are spent annually on nematicides to control nematodes, whereas in Georgia an estimated $54 million are spent annually to control nematodes on cotton, tobacco and peanuts.

As a result of widespread infestations of root-knot nematodes, nematicides are commonly used in many cropping systems with the potential of contaminating surface and ground water. Nitrogen-rich organic amendments can be used to suppress root-knot nematodes and may provide an alternative to synthetic pesticides.

The specific objectives are to:

1.) Determine if poultry manure or litter (which form is best) can be used, at environmentally sound application rates, to provide fertilizer (N, P, K and micronutrients) for a crop and suppress nematodes.

2.) Determine if the nematode suppression is due to the ammonia in the manure and litter or to organisms in the manures.

3.) Encourage the farm community to utilize this valuable resource.

Approach

Litter and manures were collected in South Carolina and Georgia and evaluated for their ability to provide plant available nutrients and suppress root-knot nematodes on cotton, tomatoes and squash. Tests were conducted in the field on experiment stations, on farms, in greenhouses and also in several controlled environment chambers.

Manure and litter applications rates were based both on a weight basis (tons per acre and also on a total nitrogen content of the litter and manure [90 pounds of N/acre]. It is important to apply only sufficient nitrogen to assure crop growth. Any nitrogen source, either organic or inorganic, if applied in excessive rates may pollute groundwater. Since the researchers also wanted to see if manure and litter, when applied in quantities suitable for nitrogen application, suppressed root-knot nematodes, fields were selected with a history of root-knot nematode problems (soil artificially infested in Georgia).

Litter and manure were applied in fashions that a farmer would normally use (distributed on the land and incorporated by machinery). Crop growth (yield, leaf and shoot growth, nitrogen in fruits and leaves), nitrogen form (in soil) and nematode development (nematode induced root damage and numbers of nematodes) were recorded.

Litter was examined to determine what microorganisms were present. Bacteria and fungi were isolated from the manure and tested to see if extracts from the organisms affected nematode development. Researchers in South Carolina worked on nitrogen form whereas researchers in Georgia worked on the potentially suppressive organisms present within the litter.

Results

Our work has demonstrated the ability of poultry litter and manure soil amendments to suppress root-knot nematodes in squash and cotton, two high value intensively managed crops. In squash, yields were comparable to inorganic fertilizer commonly used in commercial squash production and in one field were nematodes were present, litters and some manures reduced nematode damage. Several difficulties in using poul-

Project area
Waste management/pest control

Project duration
July 1993 to Dec. 1997

Budget:

SARE	
ACE	$146,696
Matching	$109,000

try litter or manure for nematode suppression is a lack of understanding of the effects of nitrogen form (proportion of total nitrogen as NH_3 within different manures) and the role of microorganisms present within the litter on nematode populations. In order to best utilize this resource we need to know what is actually suppressing the nematodes. This information will enable us to maximize the factors responsible for nematode suppression while utilizing the nitrogen present in the manure. As this project proceeds a greater understanding of the mechanisms involved in litter and manure-induced suppression of nematodes and crop nutrition will enhance our abilities to integrate the reliable use of manure and litter into commercial production units as a nitrogen source and nematode control agent.

Impact of Results

Root-knot nematodes are root parasites commonly found in southern soils and are a serious threat to profitable and sustainable vegetable and field crop production. As a result of widespread infestations of root-knot nematodes, nematicides are commonly used in many cropping systems with the potential of contaminating surface and ground water. Host plant resistance, although useful in an integrated system, can not completely solve this problem because root-knot nematodes have a wide host range and are a genetically diverse group of pathogens (multiple species and races within a species) complicating the selection of resistant cultivars. In most crops, cultivars are not available with resistance to all species or races of root-knot nematodes. The use of nitrogen-rich organic amendments to suppress root-knot nematodes is well documented and may provide an alternative to synthetic pesticides. Our work has demonstrated the ability of poultry litter and manure soil amendments to suppress root-knot nematodes and provides evidence that litter and manure can be used to replace inorganic fertilizer providing yields comparable to standard inorganic fertilizers.

Potential Contribution

A detailed economic analysis of the use of poultry litter or manure for use as a nitrogen source will provide a realistic evaluation of the benefits of nitrogen rich soil amendments on crop production. Several years of data have been collected from farms and will be used to evaluate the benefits of litter or manure use.

Plans for remainder of the project

Field and greenhouse evaluations of litter and poultry manures as a nitrogen sources for crop production and as a nematode control agent have been completed (three years). The primary emphasis during the remainder of the project will be to evaluate economic data collected in commercial production systems, and to analyze and publish the data collected in greenhouse and field trials.

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AS94-12
Final Report
December1996

Waste Management System for Loafing Areas in Dairies

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Dairy loafing areas present unique waste management problems that are not being addressed under present farm practices. These unpaved areas leading to milking barns have high animal densities and can be a source of contaminated surface runoff and subsurface leachate to groundwater. We have been studying an innovative waste management system recently installed in the participating farmer's loafing area in Putnam County, Georgia, that will capture surface and subsurface flow in a gravel-covered geotextile fabric and buried subsurface drains and route this to a lagoon. The drains were installed under half of the loafing area so comparisons can be made with soil sampling, ground electromagnetic inductance measurements, and groundwater sampling to determine if the drains or gravel and liner significantly reduce nitrate leaching.

Therefore, the overall objective of this study was to install and test a pilot system of buried drains and gravel-covered surface geotextile fabric in the loafing areas of a participating farm to capture runoff and subsurface losses of nitrogen and phosphorus and route these to a lagoon.

Approach

The loafing system was installed on a farm in Putnam County, Georgia, during the month of December 1994. The area was fenced by late spring and an initial electromagnetic survey (EM) was conducted June 1995. A second EM survey was conducted on September 1996 and additional surveys are planned as a long-term effort to monitor the development of surface and any possible groundwater contamination from manure deposition on this loafing lot.

Monitoring equipment was installed to measure surface runoff and subsurface drainage. Surface and subsurface drainage are routed first to a settling basin, which then drains to a lagoon. Four-inch perforated drain lines were placed on 25 ft centers at approximately 3 ft depths on half of the loafing area. They combine into a main drain line that is routed to a 5 ft diameter culvert placed outside the lower end of the loafing area. A central slot takes a subsample of flow to a small reservoir that is pumped by a sampler at times based on flow. Samples are stored in an automated refrigerated sampler until retrieval for analysis.

For subsurface flow, the two halves of the loafing area are separated by a gravel trench that diverts flow from the non-tile drained side away from the tile drains. At the time of establishment approximately 240 background soil samples were taken incrementally to 2 m to determine initial soil inorganic and organic N levels. After a year of operation, nitrate, ammonia and soluble phosphorus in runoff was compared to nutrient content of surface soil samples.

Results

Three rainfall runoff events captured by the monitoring equipment suggest that very little of the water (less than 0.5 percent of the total rainfall) is infiltrating to the tile drains. This result suggests that most of the nitrogen and phosphorus being lost from this field is being lost as surface flow rather than subsurface flow. In spite of this, less than 5 percent of the estimated manure nitrogen being deposited on the surface of the loafing lot could be accounted for in this short one-and-a-half-year monitoring time. A definitive mass balance will likely require several more years of monitoring.

The EM survey results show little change over this time period. It is seen on the tile drain side that there is a spot in the center that has lower conductivity values that has developed over the period of study. On the non-tile side there is an area of higher values that has developed over this same period. This could possibly indicate a removal of solute by the tile drain and an accumulation of ions on the non-tile side. The individual soil chemical analysis produced a large standard deviation and cannot be used to confirm or deny this observation at the current time.

Impact of Results

At this point the results suggest that the geotextile fabric is significantly intercepting the water flow and moving it to the surface outlet under the surface of the gravel. Less than 0.5 percent of the rainfall is found to infiltrate below the fabric to the tile drains. At this rate and, concentration of nitrate observed in the tile drainage, contamination of subsurface water at nitrate

Project area

Waste management

Project duration

March 1994-Dec.1996

Budget:

SARE	
ACE	$68,613
Matching	$26,540

concentrations and depths observed from previous EM surveys of other dairy sites would require in excess of 300 years.

Since the subsurface of these previous sites was contaminated in only 10-20 years, this result strongly supports the use of the gravel covered geotextile fabric as a groundwater protection device. The tile drainage system does not appear to be necessary since so little water in reaching it. Data will continue to be gathered over a three- to four-year period to confirm these results. However this first year's data strongly suggest that a gravel covered geotextile fabric delivering surface runoff to a lagoon can significantly lessen pollutant loading to the groundwater.

This project enabled us to establish a test plot to verify the usefulness of the technique of subsurface drain lines and surface geotechnical fabric with gravel in reducing phosphorus and nitrogen losses from dairy loafing lots to surface and groundwater.

The first year's data suggest that differences in surface nutrient accumulation are only just beginning to be apparent. Investigators at the University of Georgia and Clemson University will continue to monitor the development of nutrient profiles in the soil and water and nutrient concentrations discharged from this loafing lot over the next three years. It is expected that three to four years of operation will be required before a statistically valid accounting of nitrogen accumulating in the surface and subsurface can be made.

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Southern Region

AS94-13
LS94-59
Annual Report
December1996

Assessing the Impact of Beneficial Insect Populations on Organic Farms

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Biological control, which results from activities of natural enemies (parasites, predators and pathogens) that attack pest insects, is perhaps the most important form of environmental resistance operating to suppress pest populations. Organic farmers must rely heavily on biological control to suppress their pest populations and many release predaceous and parasitic insects, purchased commercially to augment the biological control that occurs naturally. Despite the heavy reliance of organic vegetable farmers on biological control, the occurrence of insect parasites and predators on pest populations in organic tomato production in the Southern Region has not been documented. In the absence of information on which natural enemy species are present, when they are present, which pests they attack and their impact on pest populations, it is impossible for farmers to take full advantage of biological control to protect their crops. This research project was undertaken to provide this information and had as its objectives:

Objectives

1.) Identify species of natural enemies present in organically grown tomatoes.

2.) Characterize the seasonal patterns of abundance for important natural enemy species.

3.) Identify the important prey or host species for these natural enemies.

4.) Document the impact of naturally occurring biological control on populations of key pest species.

5.) Measure the impact of releases of commercially purchased lacewings and *Trichogramma*.

Approach

These objectives were addressed by sampling populations of insect pests and their natural enemies weekly in commercial plantings of organically grown tomatoes on four farms in North Carolina. To quantify the impact of biological control on aphids, the growth of potato aphid populations caged to exclude parasites and predators was compared with that of comparable aphid populations at the same location that were exposed to natural enemies.

In addition, to quantify the level of parasitism and predation on tomato fruitworm eggs, a constant number of "sentinel" egg clusters were placed in each field on a weekly basis through the season and the extent to which they were parasitized or preyed on was recorded. All parasites and predators were collected for identification. The impact of releasing purchased *Trichogramma* egg parasites on the level of parasitism of tomato fruitworm eggs was also measured on two occasions using sentinel egg clusters.

Results

The findings during the first year of this project demonstrate that biological control by naturally occurring insect parasitoids and predators was very important in the suppression of insect pest populations in organic tomato production. In particular, egg parasitism of both hornworm eggs by *Trichogramma spp.* and *Telenomus sphingis*, and also of fruitworm eggs by *Trichogramma spp.* was generally high and at times approached 100 percent.

These high levels egg parasitism, in combination with egg predation, primarily by green lacewing larvae and lady beetles, appeared to play a crucial role in making organic tomato production an economically viable enterprise. Larval parasitism was less significant, not only because it was lower and highly variable, but also because it did not prevent the larvae from damaging the plants and fruit.

Impact of results

Results from the 1995 and 1996 seasons suggest that the naturally high levels of egg parasitism make the benefits of releasing purchased *Trichogramma* for control of hornworms and tomato fruitworm unpredictable, unless the releases coincide with periods when natural parasitism is low. To maximize the benefits of such releases, farmers will require a knowledge of the how parasitism levels change over the season.

Naturally occurring biological control of aphid populations was also shown to be important in restraining aphid populations. The control offered tended to be not the suppression of the aphid populations but the reduction of the rate of growth. Its importance, though, varied locally within fields. Both plant condition and

Project area

Beneficial insects

Project duration

Sept. 1994-Dec.1997

Budget:

SARE	$17,735
ACE	$37,207
Matching	$14,068

rainfall seemed to be major factors in the decline of aphid populations. These results suggest that one or more well timed release of aphid predators (e.g. green lacewings) could prove valuable in preventing the development of damaging aphid populations in organic tomato plantings.

Two years of data have provided support for the findings presented in this report. Completion of processing and identification of collected insects, and statistical analysis on the data remains to be done to validate conclusions presented in this report. Once that is done, the results will provide organic farmers with information required to determine the value of releasing purchased parasitoids and predators to control tomato fruitworm, hornworms, and aphids.

The results will also provide the first thorough documentation of the impact of naturally occurring biological control in organic tomato production in the Southern Region. As such, it will help identify the level of biological control that can be obtained when conventional production practices are modified to accommodate the important biological control agents.

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Forage, Biomass and Biogas Integrated Systems for Animal Waste Management

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Alternative outlets for animal waste disposal and recycling must be developed to reduce the waste stream and result in sustainable use of nutrients. This project is studying an integrated biomass and biogas energy production system as a tool for managing animal wastes.

Objectives

1.) Determine nutrient removal from the waste stream via energy production and nutrient fate when land-applied to switchgrass.

2.) Determine total energy production from an integrated biogas-biomass system.

3.) Examine the economics of the system and components including environmental impacts.

Approach

A large bioreactor on a cooperating dairy farm has been successfully renovated and will begin generating methane from dairy manure for on-farm energy use in 1997. Large plots of switchgrass were instrumented at the Texas A&M University Agricultural Research and Extension Center at Stephenville. Dairy waste was applied to the plots to determine nutrient removal in biomass, residual nutrients in the soil, movement of nitrate-nitrogen in soil water and nutrients in surface runoff water.

Results

During 1996, no significant movement of nitrate-nitrogen was detected in soil water under switchgrass, nor were there significant elevations of nutrients in the runoff water from manure-treated plots. In fact, quality of runoff water from untreated portions of the plots used as vegetative filter strips for manure-treated areas was improved.

The amounts of fibrous solids generated on three dairy farms by the use of different types of manure solids separators are also being measured. These fibrous solids have value as a biofuels feedstock, animal bedding, compost, and, if properly treated, an improved animal feed. Production of solids has ranged from 250 cubic feet per day to 1950 cubic feet per day depending on the dairy size, time of the year and separation method. Samples of the screened solids and switchgrass biomass will be treated via ammonia fiber explosion (AFEX) to enhance the value for feed and fuel.

Thus, the most important findings from the first two years of data collection is that using switchgrass for land application of dairy wastes can prevent leaching of nitrate-nitrogen, and, if used as a vegetative filter strip, can reduce concentrations of pollutants in surface runoff water.

Project area
Integrated systems

Project duration
March 1994-Dec. 1997

Budget:

SARE	
ACE	$101,180
Matching	$157,894

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AS94-16
Annual Report
December1996

Development of Guidelines for and Demonstration of Efficient Treatment of Swine Lagoon Wastewater by Constructed Wetlands

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Project area
Waste management

Project duration
March 1994-Dec. 1997

Budget:

SARE	
ACE	$130,325
Matching	$78,553

Animal waste management practices are under scrutiny because of their potential impact on the environment. Many swine production facilities employ liquid waste management systems with lagoons as temporary waste storage structures. Odors and the potential for water contamination are frequently cited as problems of such operations. Depending on the capacity of the lagoons, the liquid waste must be periodically land spread to avoid overflow of the lagoons. Odors are particularly evident during land application of lagoon stored swine waste. This currently used animal waste management practice is often criticized and therefore, alternative swine waste management systems are needed which can reduce the impact of the waste on the environment and which can reduce the conflict between swine producers and homeowners who reside near swine operations. Constructed wetlands have been acclaimed as a new liquid waste management strategy that can reduce the impact of the waste on the environment and reduce odors that would otherwise be associated with land spreading of the lagoon stored waste. Constructed wetlands were first used in Europe and Scandinavia as an effective and affordable alternative to conventional municipal wastewater treatment systems. The success of constructed wetlands for treatment of municipal wastewater has stimulated interest to adapt the technology for treatment of wastewater from animal production facilities. Low construction and operation costs and the use of land as an intensive wastewater treatment site rather than a costly, treatment plant are some of the benefits that make constructed wetlands attractive for treatment of agricultural wastewaters. A project was initiated in Alabama to demonstrate the potential and efficiency of constructed wetlands for treatment of swine lagoon wastewater.

Ojectives

1). Develop guidelines for efficient operation of constructed wetlands for bioremediation of swine lagoon wastewater.

2). Determine impact of wetlands treating swine lagoon wastewater on groundwater quality.

3). Demonstrate efficient swine lagoon wastewater treatment by wetlands to regulatory agencies and to area livestock producers.

Approach

The wetland treatment system used in this project was constructed at the Sand Mountain Agricultural Experiment Station at Crossville, Alabama, in the late fall of 1988 according to design criteria from the Tennessee Valley Authority for constructed wetlands treating municipal wastewater. A one acre system, consisting of an upper and lower tier of five, 0.1 acre (26 feet wide x 164 feet long) cells was constructed to treat the swine manure from a 500 pig/year farrow to finish operation. Each wetland cell was planted with emergent aquatic plants in the spring of 1989. The four major plantings were broadleaf and narrowleaf cattail, soft-stem bulrush and common reed. Manure was hydraulically flushed from the swine facilities into a primary anaerobic lagoon which flows to a secondary lagoon. Wastewater from the secondary lagoon is combined with pond water in a "mixing pond." Effluent from the mixing pond is distributed to each of the five cells in the upper tier of the wetland.

Three studies have revealed that constructed wetlands are highly efficient at treating swine lagoon wastewater. However, the wetland technology works best for treatment of dilute wastewaters, therefore, some pre-treatment of the raw waste is required before the waste enters the wetlands. A two-stage, anaerobic lagoon is ideal for pre-treatment which reduces the waste load to the wetlands by about 60 percent. The size of the wetlands relative to the amount of wastewater that can be efficiently treated by the wetland also is an important factor.

Important questions are yet to be resolved regarding the treatment efficiency of wetlands. Will swine lagoon wastewaters treated by constructed wetlands be allowed to be discharged to the environment? And secondly, if the discharge is permitted, what degree of treatment will be required? The USDA/Natural Resource Conservation Service (USDA/NRCS) has indicated that outflows from efficiently operated constructed wetlands treating animal wastes should have less than 10 ppm of ammonia-nitrogen, 30 ppm to-

tal suspended solids and 30 ppm of biological/biochemical oxygen demand (BOD_5).

Based on a 57-month study at the Crossville, Alabama, study site these treatment criteria were achieved when the wetlands were loaded with lagoon wastewater at a rate of 4 lbs BOD_5/acre/day. This BOD_5 loading rate was achieved after the swine waste had undergone pre-treatment in the two-stage anaerobic lagoon followed by treatment in a 0.25 acre mixing pond.

This pre-treatment scheme has worked well particularly to reduce the ammonia content of the lagoon water which at high levels can be toxic to some wetland plants. No ammonia toxicity has been observed during the six-year use of the wetlands.

Results

Based on three studies the four lbs BOD_5/acre/day wastewater loading rate appears to be the maximum at which constructed wetlands can be loaded to achieve sufficient wastewater treatment to meet the wetland discharge criteria recommended by the USDA/NRCS. Using the concept of the waste pre-treatment scheme and the one acre wetland at the Crossville study site, the system would be adequate to treat the waste generated annually by 500 pigs.

In addition to such benefits as eliminating odors and potentially polluting nutrients from wastewater, the quality of water from properly operated constructed wetlands is similar to the quality of a water from well-managed farm ponds. Because the water is treated, the livestock producer has options to manage the water as a resource rather than as a liability. The major benefit of constructed wetlands may be the conservation and reuse of wastewater rather than its disposal, which can create environmental concerns.

The impact of wetlands treating swine lagoon effluent on groundwater quality was determined by analyses of water samples from deep wells and lysimeters in proximity of the wetlands. Long term monitoring of the deep wells surrounding the wetlands and the lysimeters buried beneath the wetlands revealed no contamination of groundwater. This can be considered a positive contribution of constructed wetlands. The nutrient concentration of the wastewater is significantly reduced by the wetlands and wastewater nutrients do not migrate through the soil, into the groundwater. Other methods of wastewater disposal and treatment, such as irrigation of lagoon wastewater, can easily contaminate groundwater and surface water with high nutrient concentrations or bacteria if excessively applied to land or if runoff occurs during irrigation.

Impact of results

The benefits of constructed wetlands have been demonstrated and discussed with regulatory agencies and area livestock producers on several occasions. Researchers, regulatory agency personnel, producers and laymen have toured the wetland site to see the wetland design in operation. Wastewater treatment efficiency relative to quantity of waste treated by constructed wetlands and the advantages of using constructed wetlands systems have been discussed. Individuals are able to assess the system given the information on the effectiveness of the wetland system for wastewater treatment.

On several occasions seminars at research and technical meetings have been given to agency personnel, researchers and producers to convey the success story for this constructed wetland system. Such situations have also created an open forum to discuss the potential pitfalls and future of this technology for environmentally sound livestock waste management. A handbook of guidelines for treating swine lagoon wastewater by constructed wetlands is forth coming, once the information from the current research is complied.

Milestones of the project to date are:

1). The wastewater treatment efficiency of the wetlands has been successfully sustained for nearly six years without impairment to the wetland system,

2). At a loading rate of four lb BOD_5/acre/d, wastewater treatment efficiency of the wetlands meets treatment criteria suggested by the USDA/NRCS. Higher loading rates reduce wastewater treatment efficiency and limit the use of the recycled water,

3). Groundwater collected from beneath the wetland and from wells around the wetland show no evidence of groundwater contamination from the wetland wastewater treatment system,

4). Producer involvement indicates an interest in constructed wetland technology, but some producers are reluctant to initiate the immediate economic investment associated with the construction of a wetland system with long term benefits.

However, the eminent dilemma faced by some producers to minimize the environmental impact of their operation or be forced out of business or face potential lawsuit may provide momentum to include constructed wetlands in the scheme of agriculture waste management.

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Annual Report
December1996

Biological Control Methods for Citrus Rust Mites and Spider Mites on Florida Citrus Utilizing Predaceous Arthropods as Part of IPM

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In the recent past, biological control of citrus rust mite, *Phyllocoptruta oleivora* (Ashmead) (Acari: Eriophyidae) on Florida citrus focused on use of the pathogenic fungus, *Hirsutella thompsonii* (McCoy 1996). This pathogen is density dependent and requires moderately high numbers of citrus rust mites to exert a temporary decline in population density. The citrus rust mite has been identified as an economic mite pest on Florida citrus due to its common occurrence and high densities on leaf and fruit surfaces, persistence in pesticide sprayed grove sites and the mite's ability to cause rind blemish injury and reduced fruit quality to immature and mature citrus fruit. Florida citrus growers spray copper compounds to reduce fungal disease problems, such as greasy spot and melanose, and use miticides to suppress one or more species of phytophagous mite pests each year depending upon variety, season, value of the crop, etc. The net result is seasonal changes in populations of citrus rust mite from low numbers surviving through the winter, increasing in the spring on leaves and twigs and then migrating to fruit where populations rapidly increase and economic damage results unless control options are taken. Changing the rate of increase of rust mite populations at one or more times during the year can be achieved with the use of predaceous mites. *Hirsutella thompsonii* alone cannot contribute to the sustained decline of citrus rust mites over time. Earlier attempts by some researchers to accurately measure the potential impact of selected predators on citrus for rust mite control failed for several reasons. Utilization of predators for phytophagous mite suppression has been documented in several crop systems including apple, strawberry, hops and greenhouse vegetables. The potential for using predaceous mites on Florida citrus to regulate phytophagous mite pests, especially citrus rust mite, is being investigated. The species composition, frequency and distribution of predaceous, fungivorous, saprophytic and phytophagous species are needed to understand the complexities within this commodity. Improving our understanding of how such a complex of arthropods interact and directly or indirectly impact populations of pest mite species over time is important. Surveying Florida citrus groves for beneficial arthropods was undertaken by M. H. Muma and H. A. Denmark in the 1950's and 1960's (Muma 1970, 1975). Since that time numerous changes have evolved in citrus production practices in Florida, including new cultivars, irrigation methodology, improved fertilization, utilization of new classes of registered pesticides, elimination of many older, broader spectrum pesticides, improved crop protection methods, and changing complexes of insect and disease pest problems.

Objectives

1.) Determine the seasonal occurrence and distribution of *Agistemus floridanus* (Acari: Stigmaeidae) and other predaceous arthropods within individual trees in seven selected commercial citrus grove sites located in central and south Florida for one year.

2.) Identify important weed (ground cover and vine) plants within the citrus groves that contain *A. floridanus* or other prevalent species of predaceous arthropods during the year. Determine when specific ground cover plants are flowering within each selected grove site. Determine if there is seasonal or vertical movement of predaceous mites or insects between citrus and ground cover vegetation or vines within the groves.

3.) Determine the life table parameters of *A. floridanus* and other selected prevalent predators including developmental rates, reproductive potentials, and number of female progeny produced per adult female in the laboratory when provided with citrus rust mite as the food source.

4.) Determine comparative toxicities of all registered pesticides (including insecticides, miticides, fungicides and herbicides) used in the Florida citrus industry at recommended and reduced field rates against *A. floridanus* populations and one or more other selected prevalent species of predaceous mites or insects based on results from Objective 1.

5.) Establish experimental citrus grove sites with other farmers previously on chemical mite control programs and implement augmentative

Project area
IPM

Project duration
March 1995-Dec. 1998

Budget:

SARE	$75,000
ACE	$50,512
Matching	$90,000

infestations of selected predaceous arthropod species and ground cover plants (if appropriate) and modify spray programs to minimize toxicity to the selected predators. Continued monitoring of these sites will be completed during years two and three of the project to establish successful biological control of the targeted mite species and fine tune the methods.

Approach

Field sampling (objectives 1 and 2) has been completed. A total of 1,834 samples have been processed and over 20,000 slides prepared to date to identify various mites to species. We currently have about 1,600 samples remaining to be processed, slide-mounted and the predaceous, fungivorous or phytophagous mites identified to species. Expected completion is May-June 1997.

Several species of *Euseius* (Acari: Phytoseiidae) have been identified from the literature as being of potential importance for use in controlling citrus rust mite (Childers 1994). *Euseius mesembrinus* is a prevalent native species (probably introduced from Texas within the past 30 years) and two species of exotic predators (i.e. *E. stipulatus* (Athias-Henriot) and *E. victoriensis* (Womersley) show the most promise to date. Earlier work indicated that *E. mesembrinus* was unable to feed and reproduce on citrus rust mite when confined in a citrus leaf arena. Additional experiments will establish if this is true or if the leaf arena design is not an effective test environment.

Results

Agistemus sp near *industani* Gonzalez (an exotic predator) and *A. floridanus* Gonzalez (an indigenous species) are capable of feeding and reproducing when provided with citrus rust mite as the only food source. Egg production of the two *Euseius* species is substantially lowered when provided with only rust mites as a food source. However, both phytoseiid species are capable of eliminating confined colonies of rust mites despite reduced oviposition levels. Both stigmaeid species also eliminate confined colonies of citrus rust mite.

Our work strongly contradicts research reported by Muma and Selhime (1971). It is evident that they did not maintain the predator in a suitable environment to accurately assess potential feeding rates. Preliminary studies indicate that there are differences among some of the predators feeding on rust mites on fruit versus leaf surfaces.

Plans for Remainder of Project

One of the objectives of this study will be to determine the comparative toxicities of all pesticides currently used on Florida citrus. It is anticipated that this part of the project will be completed during 1997. The final objective of this study was designated for years two and three where selected grove sites would be divided into four treatment regimes including: (1) the convential pesticide spray program, (2) adding selective arthropod predators and possibly selected ground cover plants along with the elimination of all toxic pesticides determined from objective 4, (3) placing replicated cuttings of branches, leaves and fruit from citrus grove sites with effective citrus rust mite and spider mite suppresion at different times of the year, and (4) an untreated and non-inoculated control will be established at each location.

Because of delays in obtaining USDA APHIS permits to move selected exotic predators from quarantine facilities in Gainesville to my laboratory, losing selected predaceous mite cultures in the laboratory and recent added requirements to obtain prior approval to release selected predaceous mites following preparation of an impact statement for each species, this part of the research objectives will be delayed or modified until the third year.

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Southern Region

AS95-20
Final Report
December1996

Natural Enemies, Viral Insecticides and Improved Information Delivery for Management of Lepidopterous Pests in Transgenic B.t. Cotton

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Insect management on conventionally produced cotton in the Southeast still depends on repeated applications of synthetic chemical insecticides even though the "Boll Weevil Eradication Program" (BWEP) has resulted in reductions of these applications. Research in South Carolina has demonstrated that early-season applications for control of tobacco budworm (*Heliothis virescens*) to protect initial fruiting structures are not generally needed because of plant compensation. Also, research has quantified that natural enemies of insects increase substantially in early season in the absence of these applications. With the advent of transgenic *B.t.* cotton and its integration into grower production systems, we will be afforded even greater opportunities for substantial reductions in "hard" pesticides for insect control.

B.t. cotton is essentially a genetically different crop, particularly in relation to insect management. Current information indicates that it will virtually eliminate *H. virescens* as an economic pest; control of the cotton bollworm (*Helicoverpa zea*) is good except under very high pressure; and some suppression of soybean looper (*Pseudoplusia includens*) occurs. However, fall armyworm (*Spodoptera frugiperda*) and beet armyworm (*S. exigua*) are not controlled and can cause extensive damage in *B.t.* cotton in the southeast. Because viruses have demonstrated effectiveness against these pests on conventional cotton in the past, and since populations of natural enemies have been severely reduced by synthetic chemical insecticides, a strong effort is needed to determine and utilize their combined effectiveness in *B.t.* cotton production systems.

Objectives

1.) To quantify and assess impact of insect pests and their natural enemies in transgenic *B.t.* cotton compared with conventionally managed cotton.

2.) To determine efficacy of and develop viral microbial insecticides against lepidopterous pests developing in transgenic *B.t.* cotton.

3.) To develop delivery methods for the integration of *B.t.* cotton and viral insecticides into grower-driven crop production systems.

Approach

We used large on-farm plantings in several locations as well as on experimental stations to conduct the research. Large areas treated early in the season with synthetic chemical insecticides to destroy beneficials were compared with untreated areas to determine the role of beneficials in two cotton types; the genetically engineered B.t. cotton and conventional or standard cotton. Then small plot tests were conducted to compare microbial (or viral) insecticides with currently used synthetic chemicals to determine caterpillar control and their impact on beneficials.

Beneficial parasites and predators were sampled before and after use of "harsh" insecticides in early season in large plantings. Also, counts of all insects, pests and beneficials were made before and after applications of the "soft" viral and "harsh" synthetics to control caterpillars later in the growing season.

Results

Our results demonstrated that farmers should not apply "harsh" synthetic chemical insecticides in June to either the genetically engineered B.t. cotton or conventional cotton because of high mortality to beneficials. Where beneficials were destroyed in B.t. cotton, populations of important caterpillars such as bollworm and fall armyworm increased to economic levels later in the season, requiring additional controls. We also found that, to control these caterpillars, "soft" insecticides were not as effective as expected. Synthetic chemicals applied judiciously in mid- to late-season controlled these caterpillars better than microbials, producing higher yields. Destruction of beneficials at this time of the season did not cause pests to resurge to damaging levels later in the season. Also, there was no long-term damage to beneficials, and they increased during the fall and spring to reach high levels by the next year (1995-1996).

Impact of Results

Some 19 percent of South Carolina's 350,000 acres were planted to B.t. cotton in 1996. Growers have indicated an increase in their B.t. acreage in 1997. Our results have helped growers adapt this "environmentally friendly" technol-

Project area
Pest management

Project duration
March 1995-Dec. 1996

Budget:

SARE	
ACE	$37,820
Matching	$46,759

ogy to their farming systems. We will continue to examine "soft" controls and conservation of beneficials in B.t. cotton; and our results should play a vital role in sustaining B.t. cotton systems.

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AS95-21
Annual Report
December1996

Reduced-Risk Cockroach Control in Confined Animal Production

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Central to the philosophy of integrated pest management (IPM) is the idea that treatment should be based on need. Yet, current cockroach suppression practices in both urban environments and swine production rely heavily upon multiple scheduled applications of broad-spectrum insecticides with little concern about pest population size. This is primarily due to lack of efficient detection and monitoring tools for cockroaches. Therefore, a major motivation of this project is to study the utility of cockroach pheromones in the implementation of IPM principles in managing cockroaches. The goal is the isolation, identification and synthesis of the sex pheromone of the Oriental cockroach.

Laboratory and field studies will evaluate the utility of these compounds for integrated cockroach management in swine houses. Integration of the sex pheromone with reduced-risk insecticide bait formulations, insect growth regulators and biological control agents will also be studied. Each component of the resulting reduced-risk pest suppression program will be demonstrated on a commercial farm. Reference and training materials (manuals, interactive computer, videos) on reduced-risk pest control techniques will be developed and made available to target audiences, including commercial producers (confined livestock and poultry) and county extension personnel.

It is anticipated that the long-term impacts of this project will include the following: Pheromones will reduce insecticide use, increase accessibility to pests that retreat into insecticide-free cracks and crevices, increase the efficacy of insecticides, serve as highly specific agents with negligible mammalian toxicity, permit the viability of reduced-risk biopesticide approaches such as biological control agents, reduce costs and will have a direct impact on the quality of worker health, the environment and swine production.

Objectives

1.) Identify the volatile sex pheromone of the Oriental cockroach and integrate it with other biopesticides (e.g., repellents, biological control agents, insect growth regulators) to effect reductions in pest populations.

2.) Demonstrate each component of the reduced-risk pest suppression program on a commercial farm, develop reference and training materials (manuals, interactive computer, videos) on reduced-risk pest control techniques and make these available to target audiences, including commercial producers (confined livestock and poultry) and county extension personnel.

Approach

A three-pronged approach will be used to document and demonstrate reduced-risk pest control approaches in confined animal production systems.

1.) Laboratory and field research will result in the synthesis of pheromones that are needed for the development of better pest management practices.

2.) Laboratory and field studies will evaluate the utility of these compounds for integrated cockroach management in swine production.

3.) In cooperation with a swine research facility and a commercial producer, participants will demonstrate the efficacy of this program and quantify reduction in human health and environmental risks.

Results

The findings during the first year of this project demonstrated that adult males of the Oriental cockroach, *Blatta orientalis*, responded to periplanone-B, a sex pheromone previously identified for the American cockroach, *periplaneta americana*. The female Oriental cockroach emits a unique pheromone which we have not been able to identify. Work is progressing toward isolation and identification of this pheromone. Nevertheless, the results indicated that a slow-release formulation of periplanone-B, produced and formulated by Hercon Environmental (Emigsville, Pennsylvania) could be used to monitor populations of the Oriental cockroach. Both laboratory and small-scale field studies confirmed the effectiveness of this formulation in detecting and monitoring cockroach populations.

Unfortunately, studies on the integration of pheromone with biological control agents and with reduced-risk bait formulations were extensively disrupted by two consecutive hurricanes in 1996. Field plots were badly damaged and data

Project area
Pest management

Project duration
March 1995-Dec. 1996

Budget:

SARE	
ACE	$38,840
Matching	$15,889

collection was discontinued. Additional data on this will be collected in 1997, and we anticipate completing this phase of the work after the summer of 1997.

The demonstration phase of this project, as well as development of educational materials for growers, will have to await completion of the earlier phases of this project. We anticipate no pitfalls in the implementation of the educational component.

The results will provide the confined animal industry with a tool for monitoring pest cockroaches. Also, the utility of biological controls and baits will be documented in comparison with conventional strategies that are currently used to implement pest reduction.

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AS95-22
Final Report
December1996

Biological Control of Silverleaf Whitefly in Floriculture

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Silverleaf whiteflies are a serious pest of many field and floricultural crops and chemical insecticides are relied upon for control. In addition to environmental and worker exposure risks, the effective use of insecticides for whitefly control can be greatly diminished through the development of insecticide resistance by these insects. Use of alternative control methods in addition to chemical insecticides would not only reduce environmental and worker contamination risks, but also would relieve pressure on the insects to develop insecticide resistance. This, in turn, would sustain the efficacy of the insecticides while reducing the amounts of chemicals required to successfully suppress this pest.

One such alternative is the insect-attacking fungus Paecilomyces fumosoroseus (PFR). PFR infects and kills all stages of silverleaf whiteflies and has been developed for commercial use on floricultural crops produced in greenhouses. Plant diseases must also be controlled on such crops, such control usually being achieved through chemical fungicide applications. For a successful IPM program utilizing a beneficial fungus such as PFR for whitefly control compatible fungicides that will not inhibit PFR must be identified and safe intervals determined for their use.

Objectives

1) Determine fungicides compatible with PFR and application schedules of compatible fungicides for use with PFR.

2) Determine the efficacy of treatment of plant material with PFR for eliminating whitefly infestations during propagation and prior to shipping to producers.

3) Determine the efficacy of PFR in managing whiteflies under commercial production conditions in comparison to the conventional chemical control.

Approach

To determine fungicide compatibility with PFR, a laboratory bioassay was utilized in which PFR was grown in Petri dishes and exposed to fungicide-saturated filter paper discs. Aliette, Potassium bicarbonate, Captan, Chipco26019, Cleary's 3336WP, Daconil, Fore, Kocide, Subdue, Systec, Terrachlor, and Triforine were tested, at the manufacturer's recommended rate, along with 10% clorox (as an inhibition standard) and distilled water (as a no-inhibition standard). Inhibition of PFR growth was assessed following a 72 h period of exposure to the treated discs.

Potassium bicarbonate, Captan, Daconil, and Triforine were identified as inhibitory to PFR.These fungicides were then included in additional bioassays to determine their comparative strengths of inhibition. Aliette, although not determined to be inhibitory to PFR germination, was included in these further tests because of its widespread and frequent use in floricultural crop production. The same procedures were followed as before, however, widths of the zones surrounding each treated disc in which PFR growth was inhibited was measured. We refer to these areas as the zones of inhibition (ZOI).

Each fungicide in the inhibitory subset were applied to greenhouse-grown lantana plants to develop treatment schedules of the fungicides and PFR that would not diminish the efficacy of PFR. After 0, 3, 7, and 14 days after fungicide treatment, plants were treated with PFR and leaf rinses collected. Samples of these rinses were then plated on artificial media in the laboratory and PFR germination assessed by counting colonies. The effect of fungicide on PFR growth also was assessed by measuring the diameter of a random sample of colonies.

The efficacy of preshipment treatment of rooted cuttings with PFR to eliminate existing whitefly infestations was determined cooperatively. Verbena cuttings (cv. Homestead Purple) were rooted at the Research and Education Center, University of Florida, Apopka, FL greenhouses. Cuttings were allowed to become infested by silverleaf whiteflies and counts of these insects made on individual leaves. Cuttings were then treated with varying rates of PFR, placed in coolers to simulate shipping conditions, and then held for 1 week at low (one half of the cuttings) or high humidity (the remaining half). Whiteflies were counted and %mortality determined.

Additional cuttings on which whitefly numbers had been counted were treated with varying rates of PFR, with and without a wetting agent

Project area
Biological control

Project duration
March 1995-Dec. 1996

Budget:

SARE	
ACE	$45,389
Matching	$11,250

(Cell-U-Wett; C.S.I., Michigan City, IN) and shipped overnight to the Experiment Station in Griffin, Georgia. The numbers of alive, dead, and emerged whiteflies were then counted on the individual leaves.

Commercial production use of PFR was assessed at the Georgia Experiment Station and at commercial cooperators: Bill's Greenhouses, McDonough, GA and Camp and Co. Greenhouses, Dacula, GA. Lantana cuttings which had received PFR treatments during propagation or prior to shipment and cuttings which had received no treatment were grown to a saleable size in 10-cm square pots. Weekly whitefly counts were made on plants in the following production treatment groups: 1) PFR preshipment / PFR production, 2) PFR / imidacloprid (Marathon=AE, Olympic Chem. Co., Mainland, PA), 3) none / PFR, 4) none / imidacloprid. When the cuttings were established a single imidacloprid treatment was applied to plants in treatment groups 2 and 4. At this time, a series of 4 applications, made.at a 1-week interval, of PFR were initiated on plants in treatment groups 1 and 3.

Results

Of the 12 fungicides tested in the laboratory the following were not observed to be inhibitory to the germination of PFR: Aliette, Chipco26019, Cleary's 3336WP, Fore, Kocide, Subdue, Systec, and Terrachlor. Potassium bicarbonate, Captan, Daconil, and Triforine did inhibit PFR germination, although, only the inhibition associated with Daconil was statistically significant. In addition, Daconil consistently and significantly inhibited PFR growth, whereas Sodium bicarbonate and Triforine each inhibited PFR growth in individual tests, but the overall level was insignificant. Aliette neither inhibited germination nor growth of PFR.

Similar results were obtained when fungicide effect on germination and growth of PFR on plants treated in the greenhouse was assessed. Aliette did not affect colony number or width. Neither Potassium bicarbonate nor Triforine reduced PFR germination or growth, on the contrary, a significant increase in colony width was observed 3 days after treatment with Potassium bicarbonate. Only Captan and Daconil significantly reduced numbers of PFR colonies one day after fungicide treatment. Furthermore, these two fungicides reduced mycelial growth, an effect sustained three and seven days after treatment. These results suggest a safe interval of at least three days after a treatment with Aliette, Potassium bicarbonate, or Triforine prior to an application of PFR. If Daconil must be used, application of PFR should not be made sooner than 14 days after treatment.

The use of Captan in an IPM program, which includes PFR is contraindicated by the greenhouse results. The potential compromise of PFR by the use of Captan was not indicated by measuring zones of inhibition in the laboratory bioassay. However, Captan was included among the fungicides selected from the initial list for further testing because of the detection of inhibition, although at a statistically insignificant level. The possibility of false negatives in the laboratory strongly suggests that fungicide effects should be examined on treated foliage in addition to growth-media in the laboratory.

Treatment of rooted cutting with PFR prior to simulated or actual shipment consistently reduced whitefly infestations, although not all treatment combinations resulted in significant reduction. Results of the simulated shipments indicate 5 g PFR formulated material per liter will reduce whitefly infestations by 52.52% on cuttings held at lower humidity following shipment. Cuttings treated with 5 g PFR per liter again resulted in the highest mortality levels with the wetting agent (86.9%) or without it (86.8%).

Lantana cuttings which were propagated by Camp and Co. Greenhouses were not treated during rooting. There was little or no whitefly pressure during this period. One-half of the rooted cuttings were treated prior to shipment to Bill's Greenhouses at which time we were unable to find a single whitefly immature among the material. These cuttings were divided into their respective production-treatment groups and followed until sale, 4 weeks after the last PFR treatment. Although whitefly pressure was never great, plants receiving PFR during production consistently had fewer whiteflies than imidacloprid treated plants (these differences were significant on 2 of the 5 count dates).

Both lantana and verbena cuttings were propagated and then grown to saleable size at the Georgia Experiment Station under more intense whitefly pressure than that encountered at our commercial cooperators. Plants which had received PFR applications during rooting had lower mean numbers of whiteflies during early production than did plants which had received no treatment. This difference was particularly evident among the verbena plants. Furthermore, PFR production-treated plants had statistically indistinguishable numbers of whiteflies from those on imidacloprid treated plants.

Impact of Results

The results of this project clearly demonstrate the effective use of a biological control agent in floricultural greenhouse production in the southeastern United States. Specifically, the insect pathogenic fungus, Paecilomyces fumosoroseus (PFR), provided efficacious control of the silverleaf whitefly, Bemesia argentifolii, on lantana and verbena. Levels of control achieved with this fungus were statistically indistinguishable to those obtained through the use of the current chemical insecticide standard, imidacloprid. In addition, this research demonstrates the effectiveness of pre-shipment PFR treatments to eliminate whitefly infestations on propagated plant material. Through early infestation control during crop production, total pesticide use will be reduced.

The results of this study also provide lists of both PFR-compatible and incompatible fungicides to aid growers in fungicide treatment decisions within a pest management program that includes the use of PFR. Furthermore, these results provide growers with safe time intervals for scheduling compatible fungicide and subsequent PFR applications so that the efficacy of PFR will not be compromised.

These results provide floricultural growers with information to successfully utilize an alternative control strategy for one of the industry's most important insect pests. Alternatives, such as PFR, to chemical control are more likely to be accepted if they can be demonstrated to be efficacious and that their use will not compromise the control of other pests, such as fungal plant pathogens. Through the use of alternatives, chemical pesticides will be used less often which will reduce environmental contamination, worker exposure, and the development of pesticide resistance.

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AS95-23
Final Report
December1996

Increasing Acceptance of Low-Input Landscapes for the Southeast

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This project evaluates the relative costs and likelihood of adoption of several landscape management options.

Objectives

1.) Determine and demonstrate the aesthetic, economic and environmental costs and benefits associated with various pest management methods applied to typical southeastern landscape plants and the interaction with the cultural variable shade.

2.) Determine the feasibility and impediments to acceptance and implementation of alternative pest management approaches in southeastern landscapes.

Approach

A split-split design involving 20 mini-landscapes constructed in the Georgia Station Research and Education Garden was used to evaluate and demonstrate quality of landscapes based on pest resistant plants and on common pest susceptible plant materials under traditional, alternative (scouting-based, targeted biological and biorational), and no intervention pest management programs. The cultural variable of shade vs. no shade was also evaluated for potential influence on susceptibility to pests of landscape plant materials chosen for study.

Sampling at intervals assessed relative pest pressure and plant quality. Pitfall traps were used to collect ground-dwelling beneficial insects and spiders under each regime. Public acceptance of insect-induced injury, as demonstrated during field days was assessed and will form the basis for targeted educational programs designed to modify public expectation of what constitutes acceptable pest pressure. Therefore, we have addressed a major impediment to the implementation of biologically based landscape pest management.

Results

Results from the first (funded) year of study have already revealed the range in pest pressure resulting from differences in management strategy including varying levels of azalea lace bug on azaleas ranging from zero infestation on the resistant Plumleaf azalea to high levels of lacebugs per leaf on our completely untreated plots. Those under traditional chemical management supported only low levels of lace bugs, while those in our targeted pest management plots had intermediate levels. Plant quality assessments of these plants also varied accordingly.

A similar range in infestation levels of two-lined spittlebugs (TLS) on hollies and turfgrass was observed among our treatment regimes. Savannah hollies in untreated plots were heavily infested and new growth especially sustained high levels of damage. Common centipedegrass in these plots was also heavily infested by immature spittlebug nymphs. Beneficial insects and spiders collected in pitfall traps, however, showed little variation in population density among these plots.

Shade effects: The cultural variable shade induced striking differences in insect infestation levels and in plant quality for several of the pest and plant combinations in this study. Spittlebugs, for example were 41x more common in shaded centipedegrass turf than in the full sun plots, consistent with unpublished dogma concerning spittlebug preference for shady sites. Azalea lace bug infestations are reputedly more severe in sunny situations. In our study they were far more common in shaded plots. Recent published studies (Trumble and Denno 1996) revealed similar observations and attribute the usual lower likelihood for understory infestations to the activity of beneficial insects and spiders that are more common in wooded habitats. Ground-dwelling beneficials in this study, however, were slightly more common in the full-sun plots. Foliar beneficials on woody plants were not measured. Spiders and ground beetles were much more often collected in turfgrass than in adjacent bedding plant areas. Ants and other beneficials were more evenly abundant.

Centipedegrass in these 20 mini-landscapes experienced severe winter-kill during the experimental period. Only 16 percent of centipedegrass plots in the shade had recovered by May of this year. Recovery in sunny plots was considerably greater (39 percent) regardless of management regime. When all centipedegrass plots (sun and shade) were evaluated, those receiving targeted management had the best recovery (37 percent), followed by the untreated control plots 925 per-

Project area
Pest management

Project duration
March 1995-Dec. 1996

Budget:

SARE	
ACE	$36,826
Matching	$15,980

cent), and the those under a full program (19 percent). Bedding plant quality was also affected by this cultural factor. New guinea impatiens in full sun plots steadily declined in plant quality, resulting in quality measurements 16 weeks post-planting that were only half of those for plants grown in 50 percent shade. Homestead Purple verbena, however, was much less severely affected.

Public acceptance: Surveys during field days of growers and consumers assessed the willingness of those surveyed to purchased azaleas sustaining some lace bug damage and to recommend treatment based on damage levels. The sharpest drop in acceptance occurred with plants that displayed 10 percent damage. Treatment of plants sustaining this level of damage (10 percent) was also recommended by 55 percent of those surveyed. Seventy percent of those surveyed were interested in using pest control strategies that limited pesticide use. A similar percentage expressed willingness to tolerate some damage to limit pesticide use.

Conclusion: A targeted pest management approach achieved an acceptable standard of landscape quality in terms of pest infestations levels and plant quality compared to untreated landscapes and in relation to a full chemical management program. Monitoring activities, however, for this program are time consuming and expensive in terms of trained personnel. Resistant plant materials performed extremely well in reducing the numbers of target pests in these demonstration landscapes. Cultural management considerations were amply illustrated by effects on insect pest pressure and decline in plant quality for plants placed in improper sun or shade conditions. Workshop and field day participants expressed willingness towards an increased tolerance of insect pest pressure and low levels of damage to achieve the goal of reduction in pesticide use.

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AS95-24
Annual Report
December1996

Identifying Pesticides Most Compatible with Parasites of the Citrus Leafminer

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Objectives

The objectives of this research are to develop information on the toxicity of pesticides to a parasite of the citrus leafminer. Information about products that are least disruptive to a biological control agent of the leafminer will be transmitted to homeowners and citrus nursery and grove managers so that biological control can be maintained and pesticide use for leafminers and other pests can be reduced.

The citrus leafminer (CLM), *Phyllocnistis citrella*, has caused extensive damage to citrus trees in homeowner's yards, citrus nurseries, and groves since its introduction into the USA (Florida, Louisiana, and Texas) in 1993. The CLM reduces growth, decreases quality, and can even kill young citrus trees. The citrus leafminer is also a vector of a serious disease, citrus canker. Integrated pest management (IPM) tactics will be employed to manage the CLM, including cultural, chemical, and biological controls. Biological control by native parasites may provide some suppression of the pest, but a host-specific parasite such as *Ageniaspis citricola* may be even more effective. A classical biological control project has resulted in the establishment of *Ageniaspis citricola* in Florida and Louisiana. This parasite has established, overwintered, and dispersed from release sites and now colonized the entire 850,000 acres of the citrus-growing region in Florida and the smaller acreage in Louisiana. It is a very important biological control agent of this new pest. The use of less toxic pesticides in citrus will enhance biological control, both for the leafminer and other pests, and reduce overall pesticide use.

Approach

Two different types of bioassays are being conducted in the laboratory to obtain data on toxicity of pesticides to *A. citricola.* Our goals are to be able to predict from laboratory results the effects of the pesticides under field conditions. To do so, we have attempted to mimic the field conditions. The following products were tested because they are commonly used in citrus pest management programs and because they might be "soft" on biological control agents:

Oil

Align (azadirachtin, a natural product of the neem tree) Micromite (diflubenzuron, a growth regulator)

Eclipse (fenoxycarb, a chitin-synethesis inhibitor that inhibits molting)

Provado (imidacloprid, a systemic pesticide)

Agrimek (avermectin, a natural fermentation product of a microorganism)

Neemgard (neem oil, a mixture of natural products from neem trees)

Kocide (copper hydroxide, frequently used to control fungal diseases in citrus)

Other products to be tested include pyriproxyfen, a growth regulator.

Clip cage bioassay Adults of either the citrus leafminer or the parasite, *A. citricola,* are confined in clip cages which consist of a "sandwich" of citrus leaves treated with water, 0.25-, 0.5-, 1.0- and 2.0-fold the label rate of each pesticide tested. By testing adults of both species under comparable conditions, we can learn the relative toxicity of each product to the adults. Newly emerged adult leafminers (16 per cage) and parasites (13 per cage) are placed into clip cages, which are held at 27°C. Each treatment is replicated seven times on different dates for a total of 112 leafminer adults and 91 parasite adults. Mortality is assessed after 24 hours. Water controls are tested each test date.

Cylinder bioassays The effect of these products on immature citrus leafminers and their parasite, *A. citricola*, is important. Some products are not expected to be toxic to adults because they only affect the ability of the immature insect to develop and molt to the next stage (growth regulator).

Cylinder bioassays are time consuming but mimic more closely field conditions. Adults are introduced into cylindrical cages and allowed to oviposit. After two weeks, when the pupal chambers have formed, the pupal chambers are opened and the number of leafminer pupae and parasite pupae are recorded. By comparing the number of progeny produced in the water control with the number produced in the different treatments (0.25-, 0.5-, 1.0-, and 2.0-fold the field rate), we can identify products least likely to disrupt bio-

Project area
IPM

Project duration
March 1995-Dec. 1998

Budget:
SARE
ACE $33,125
Matching $24,487

logical control yet provide suppression of the citrus leafminer.

Results

Clip cage bioassays Agrimek, Align, Eclipse, Kocide, Micromite, Neemgard, Provado, and petroleum oil have been tested on adults of both the citrus leafminer and the parasite, *A. citricola.*

The clip cage results indicate that Align, Eclipse, Micromite, and Neemgard are relatively nontoxic to adults of both the CLM and *A. citricola.* The results with Agrimek suggested that this product is somewhat more toxic to the parasite than to the adult leafminers (54% of leaf miners survived compared to 26% at the field rate).

The results with oil were surprising, with large numbers of both adult leafminers and parasites killed at the field rate (73% and 91%, respectively) and twice the field rate (78% and 80%, respectively). This high rate of mortality was surprising because oil has developed a reputation as a "soft" product on natural enemies.

To investigate this further, a second type of clip cage bioassay was conducted with oil, in which the treated foliage was aged outdoors for one hour, 24 hours, or 48 hours before being used to make a clip cage "sandwich" of leaves. Survival of CLM and *A. citricola* after the oil was one hour old was increased (to 35 and 32%, respectively). After 24 hours, the oil was not toxic to either species, with 92 and 83% of the CLM and *A. citricola* adults surviving. After 48 hours, 93 and 68% of the CLM and *A. citricola* survived. These results indicated that oil toxicity to adults of both species is greatly reduced after 24 hours and explains why oil has a reputation as a selective "soft" product useful for IPM programs.

Cylinder bioassays Micromite (diflubenzuron), Micromite + oil, Eclipse (fenoxycarb), Eclipse + oil, and oil alone have been tested in cylinder bioassays. The other products tested in the clip cage bioassays will be tested soon.

The results indicate that Micromite alone (no oil) applied after the leafminers had oviposited kills CLM larvae. An average of 29 pupae per tree was produced in the water controls, while an average of 3, 14, 20, and 9 pupae per tree were produced after treatment with the 0.25-, 0.5-, 1- or 2-fold field rates, respectively.

When the parasite was added to the system, 26, 18, 11, 25, and 21 *A. citricola* successfully developed in the water control, 0.25-, 0.5-, 1-, and 2-fold treatments with Micromite, respectively. These results indicated the parasites were able to survive and develop after treatment with Micromite.

When Micromite + oil was applied after the leafminers had oviposited (which is a standard method of field application), survival of the CLM progeny decreased from a mean of 22 pupae per tree for the water control, to 21, 9, 5, 3 and 2 for the 0.25-, 0.5-, 1- or 2-fold application rates, respectively.

When the parasite was added to the system, even fewer leafminer pupae were produced because parasitism rates were high (74% or greater). Micromite + oil appears to be compatible with an IPM program that would include *A. citricola* as a natural enemy, although field tests should confirm this conclusion.

Eclipse (fenoxycarb) applied after CLM adults had a chance to oviposit reduced the number of pupae produced from 14 to 3, 7, 4, and 4 after treatment with water, 0.25-, 0.5- 1- or 2-fold the field rate, respectively. When Eclipse was applied after *A. citricola* had oviposited into its leafminer hosts, parasites were able to develop successfully in some of those few CLM that survived the treatment with Eclipse.

Eclipse + oil applied after the leafminer had oviposited was about as effective against the leafminer as Eclipse alone. Eclipse+ oil applied after *A. citricola* had oviposited also allowed parasites to develop (parasitism > 41%).

Oil was applied prior to allowing either the leafminers or the parasites to oviposit. Thus, the oil residue was present when adults were introduced. Oil alone reduced the mean number of CLM pupae per tree from 13 pupae per tree in the water controls to 3, 4, 0.4 and 0.4 pupae in the trees treated with 0.25, 0.5-, 1- and 2-fold the field rates, respectively. When the parasite was added immediately after spraying, no parasites were able to develop, as expected. The fresh oil residues kills the adult wasps before they can parasitize the CLM. Tests will be conducted to determine how well the parasites can survive and develop when oil is applied after the leafminers and parasites have had an opportunity to oviposit first.

Impact of Results

We will recommend those pesticides that are least toxic to this important natural enemy be used in an IPM program in groves, nurseries, and home owner's trees. This will facilitate the establishment and enhance the effectiveness of the parasite. The information obtained will be delivered to homeowners, nursery and grove managers, cooperative extension personnel, and growers via demonstration plots, publications in newsletters, trade journals, and peer-reviewed journals.

Plans for Remainder of Project

We will complete the remaining clip cage and cylinder bioassays on products used in citrus pest management and provide summaries of the results and recommendations in writing to a wide array of outlets.

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AS96-25
LS96-81
Annual Report
December1996

Controlling Cheat and Annual Ryegrass in Small Grains Using Novel Crop Harvesting Technologies

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Since McCormick first invented his reaper about 150 years ago, the age old drudgery of grain harvesting has slowly yielded to mechanization. After decades of gradual improvements, the grain binders and stationery threshing machines were finally joined together into machines known as "combined reaper-threshers". That term was soon shortened to the single word "combine", with the accent on the first syllable.

Modern grain combines are designed to rapidly and efficiently harvest and collect grain and return the straw, chaff, weed materials and weed seeds back onto the field. Over the past 75 years, grain combines have improved in numerous ways, but the primary function has remained the same. That is, collect the grain crop and return everything else to the field. An advantage of the old grain binder plus stationery thresher system of harvesting was that by carrying the bound shocks of grain and straw to the thresher, most weeds and their seeds were also carried off to one spot in the field. Our project is designed to regain this advantage by advancing the concept of grain harvesting a step further, to include separate collection of the seeds of weedy grasses that now pass through a combine and are returned to the field.

The seeds of Italian ryegrass and cheat are our primary targets because most of the seed of these noxious weeds passes through grain combines as they harvest wheat. Cheat is traditionally controlled by stubble burning and burying the seed by moldboard plowing. Widespread problems with cheat have prevented Southern Great Plains wheat growers from adopting conservation tillage.

Objectives

1.) Investigate three distinct modifications to conventional grain harvesting procedures designed to either remove cheat and annual ryegrass seed from the field during the wheat harvesting process or devitalize it.

2.) Evaluate the new harvesting procedures as a component of an integrated cultural grassy weed control system in on-farm situations.

3.) Determine the economic feasibility of the cultural weed control systems.

4.) Disseminate our findings to farmers, agribusiness, and other states.

Approach

Three approaches to removing and disposing of cheat and annual ryegrass are being investigated: a) Combine Mounted Recleaner Approach: The grain combine is adjusted to collect both the grain and weed seed, in the clean grain pan before being elevated to the grain bin, then the mixture is separated with a second cleaner (recleaner) mounted on the combine. The weed seed is either collected for feed or mechanically damaged to devitalize it and then returned to the field. The two options for disposing of weed seed were included because several wheat growers have told us that they would prefer not to collect the seed if we could just kill it and return it to the field. b) Chaff Collector Approach: Collect weed seed and shriveled wheat along with the chaff that is discharged from the combine over the cleaning sieves. Collected material is then removed from the field. Its value as livestock feed will be determined; c) Seed Cleaner Approach: The combine is adjusted to collect both the grain and weed seed in the clean grain tank. The mixture is then cleaned at the edge of the field. The weed seed and shriveled wheat is saved for livestock feed. All approaches are being compared to conventional combine harvesting for impact on weed densities, grain yields, economics and constraints.

In June 1996, we initiated field research to measure the agronomic benefits and to obtain engineering and economic data from two combine harvesting treatments designed to remove cheat and other weed seed from wheat fields. We also continued work to develop a mechanism to rapidly and efficiently devitalize cheat. The field experiment treatments were 1) harvesting wheat with the combine set to collect all cheat in the clean grain bin, 2) collection of chaff and weed seed in a trailer with the combine set to manufacturer's recommendations. The treatments were compared to 3) operating the combine set to normal recommendations with chaff collection, and 4) setting the cleaning fan at the highest air speed to maximize cleaning out weed seeds, but at the risk of expelling additional wheat

Project area
Cropping systems

Project duration
April 1996-April 1998

Budget:

SARE	$83,624
ACE	$208,624
Matching	$248,935

out of the combine (this is a common practice by farmers). All grain was recleaned with a portable Kice aspirator cleaner. This is a practice that farmers collecting weed seed with the clean grain would have to adopt. Treatments were replicated four times.

Grain yield, dockage, chaff, and cheat in chaff measurements were taken at each location. Volunteer wheat stands were measured in August and cheat stands measured in September. These experiments will continue through harvest in June 1997.

Experiments were continued to evaluate a low power roller mill and a hammer mill for use in devitalizing cheat. Micrograph sections of damaged seed have been taken to identify the type and degree of injury needed to kill the seed. In addition, a new mechanism has been designed that should increase the percentage of devitalized cheat compared with the roller and hammer mills. Construction of the device will begin in December and laboratory tests will be conducted this winter. Based on results of these experiments, a device will be designed for mounting on a combine to devitalize cheat and other weed seed during harvesting.

The Kice transportable aspirator recleaner performed very satisfactorily this past summer, but is too heavy to mount on a combine. Therefore, an aspirator cleaner is being designed to be mounted on a combine. Laboratory tests of the device will commence this winter. Also, the portable Kice aspirator power system is being changed from an electric motor to hydraulic power. During the 1996 harvest, the aspirator cleaner proved to be a high capacity, efficient cleaner. The cleaner produced grain with less than 0.5% dockage when the cheat was dry.

The cooperating farmers were different from those listed in the proposal. Drought throughout Oklahoma forced us to shift our experiments to other areas of the state. We plan to continue work with all of our cooperators.

Results

Because of widespread severe drought and resulting failures across much of Oklahoma in the spring of 1996, we had to relocate our field research from our initial cooperators' farmers to areas of northcentral Oklahoma where crops were more normal. Locating additional cooperators was not difficult. The transportable Kice aspirator used to reclean harvested grain performed well, and reduced dockage ie. weed seed and trash to 0.5% or less, which is very acceptable. More importantly, the success of the transportable aspirator type recleaners was necessary to justify further development of a combine-mounted recleaner of that type. The simplicity of the system and lack of moving parts to wear out are important features. Since this is a new project, we will not have complete results of the field tests until next June. Our farmer-cooperators have seeded their fall wheat crop now and we are all waiting to see the impact of our treatments on weed infestations.

The low power roller mill and hammer mills used to devitalize the weed seed by cracking or crushing it have performed well. Either machine can kill over 95% of cheat seed.

Impact of Results

Although this is a new project, and our first on-farm results will not be evident until June, 1997, the impact of this project on sustainable agriculture should be significant. The demonstration of inexpensive procedures to control weed infestations will permit Southern Region wheat growers to adopt conservation tillage systems. Also, the adoption of practices being demonstrated on cooperators farms will substantially reduce the need for herbicides to control the target weed species. Furthermore, the techniques and equipment being developed should be adaptable to other combine harvested grain crops such as rice, soybeans, grain sorghum, etc.

Potential Contribution

Contributions to producers from this project will include low cost nonchemical weed control, potential new source of low cost livestock feed, and the ability to reduce operating costs and conserve topsoil by adopting conservation tillage systems. Consumers will benefit from the decreased impact of pesticide use. Also, adoption of conservation tillage practices will reduce soil and water erosion which will help improve air and water quality.

Plans for Remainder of Project

Since this project is new, much remains to be done. During 1997 all aspects of the project will continue to develop. An aspirator cleaner is being designed and built this winter to attach onto the grain combine which we will then evaluate next summer in cooperators' fields along with continuing evaluation of the equipment we used during the 1996 harvest.

Economic analysis will begin after we obtain our yields from the crop now growing in the field. Dissemination of results will begin as soon as the yield and quality data from the 1996-97 crop are analyzed.

Professional Development Project Summaries

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Southern Region

Project LST94-1
LST96.8
Annual Report
December 1996

Southern Region Sustainable Agriculture Training Consortium

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The Southern Region Sustainable Agriculture Training Consortium facilitates and coordinates sustainable agriculture training for Cooperative Extension workers and other agricultural professionals. The consortium consists of a large group of stakeholders who are interested in sustainable agriculture and who participate in the annual workshop and other activities. There is a 12-member leadership committee and a three-member management team.

Objectives

1.) Develop and manage the regional professional development program through a participatory strategic planning process;

2.) Develop a consensus for a regional training agenda;

3.) Identify training needs and priorities for development of RFP's for training projects;

4.) Support regional training project leaders;

5.) Support state sustainable agriculture professional development coordinators;

6.) Develop and deliver "process skills" training opportunities;

7.) Establish linkages with other regional and national professional development efforts.

Approach

The management team and the interim leadership committee have successfully transitioned the leadership committee to a permanent committee with three members rotating off and being replaced annually. The members represent 12 states or territories across the region and a diverse array of interests in sustainable agriculture, including farmers, land grant institutions and government agencies, as well as non-governmental organizations. In addition, the committee is selected to be diverse in terms of gender, ethnic background, geographic region and personal interests and occupations. This leadership committee develops policy and programmatic directions for the Professional Development Program, which are implemented with the assistance and support of the management team.

During 1996, the leadership committee began a strategic planning process and developed the following statements:

Vision: A partnership of people working in and concerned about agriculture, sustaining a responsive network of healthy farms, healthy products, healthy communities, and a healthy environment.

Mission: To provide leadership, foster partnerships and facilitate the personal and professional growth of agricultural professionals who will create and sustain an economically viable, socially responsive and environmentally regenerative agriculture for the southern region.

Results

The leadership committee developed training priorities and released two RFP's for training projects. From the first RFP, nine projects were funded in Oklahoma, North Carolina, Kentucky, Georgia, South Carolina and Arkansas. In addition, state allocations to support professional development activities were provided to 20 land-grant institutions in the region that submitted satisfactory training plans of work. Proposals for the second RFP are due on February 11, 1997.

The management team has continued to build linkages to strengthen the professional development program within the region, with the national program and with the other three regions. First, we held a productive workshop with the state coordinators in Greensboro, North Carolina, in October 1996. From this meeting, we determined more effective means of communicating and interacting with the state coordinators, provided individual guidance for development of state training plans, and discussed means that they can use to enhance training efforts in the states.

Second, we have interacted with the national program director and his staff to implement a uniform training reporting form for use by the state coordinators and training project directors. From data collected with this system, we have documented the following professional development program accomplishments:

1.) 12 states conducted and documented professional development program training events.

Project area

Training

Project duration

March 1994-Dec. 1998

Budget:

SARE	$ 653,044
ACE Matching	$115,829

2.) Twenty six training events or activities were conducted.

3.) A total of 1,581 participants took part in these professional development activities.

Third, we have taken part in discussions with the regional coordinator from the Western Region, exploring a potential Pacific-Caribbean collaboration, and we involved the Western Region coordinator in our state coordinators workshop as a resource person. In addition, with help from the regional communication specialist, the consortium presented a display at the National Association of County Agricultural Agents' annual meeting in Nashville.

Finally, we have continued our efforts to communicate the successes, challenges and opportunities of the Professional Development Program with the Southern Region SARE Administrative Council, the Southern Sustainable Ag Working Group and its steering committee, the Southern Region Extension Directors and Administrators and the Southern Region Agriculture and Natural Resources Program Leaders, both at the 1862 and 1890 institutions.

The first Professional Development Program stakeholders workshop was held in Lexington, Kentucky in January 1996. The program focused on "teambuilding" as it relates to sustainable agriculture programming. About 150 people from the 15 states and territories participated. From this workshop, the leadership committee gained insight and ideas for subsequent training RFP's and participants valued the opportunities for interaction with peers.

The leadership committee's first two years in the program have been productive and have laid a solid foundation for the future. Perhaps the best testament to the accomplishments of the program is a statement by Charles Miller, a beef rancher and tobacco farmer from Kentucky who rotated off the leadership committee in January. He stated, "Never in my service to agriculture have I had the privilege of working with a group of people so knowledgeable, so open and so dedicated as my fellow consortium members. Our meetings are always full and intense, but never have we failed to reach a consensus on what we felt was proper for sustainable agriculture in the Southern Region."

"It seems that over the course of the past two years, we have had a great deal of urgency. We have had to play catch-up to some extent, but with our most recent meeting in October, I feel we have turned a corner as a committee. With criteria and scheduling in place, we are having time now to be more deliberate and farsighted. I believe this is reflected in our new mission and vision statements. Feedback of success stories certainly gives us an indication that all this effort is worthwhile."

He continued, "...Thank you for the opportunity to serve. It has truly been a positive learning experience for me. I wish you the best of luck in the future as you work together to provide training for a more sustainable agriculture in our Southern Region."

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LST94-2
Annual Report
December 1996

Environmentally and Economically Sustainable Use of Rangeland

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Waggoner Ranch
Kkrooked River Ranch
Nail Ranch

County extension agents are generally well qualified for their jobs, and usually come from strong agricultural backgrounds. However, most receive college degrees in animal science and agricultural education disciplines. Therefore, many have little or no formal training in the area of rangeland management and may be unprepared to effectively help producers within their counties. *The Environmentally & Economically Sustainable Use of Rangeland* project was established to provide training and education for county extension agents in rangeland management. This was accomplished through a series of three workshops conducted in one year.

Objectives

The objectives of this project were to provide course participants with the skills necessary to be able to understand and develop ecologically and economically sustainable range management practices affecting livestock and wildlife enterprises on the ranch. Specifically:

1.) Train agency personnel in setting goals and objectives and in learning techniques to assist ranchers in systematically developing alternative strategies to meet their goals and objectives.

2.) Implement the elements of the strategies for sustainable rangeland management.

3.) Evaluate the training and implementation project for further development into a sustainable rangeland management program to be made available to ranchers nationally and internationally.

Approach

The first session of the three workshops was held on July 18-20, 1995, at the Krooked River Ranch, near Haskell, Texas. This session was attended by 19 county agents from five Extension districts across the state of Texas. Each agent was required to attend all three sessions in order to complete the workshop series. The material covered during the three days of the first session consisted of learning the importance of 1) setting goals and objectives for ranch management planning and 2) economic and biological planning skills which are used to assess and monitor ranch and range conditions.

Instructors included Peggy Sechrist, president of Holistic Resource Management (HRM) of Texas, Dr. Larry White, extension range specialist with the Texas Agricultural Extension Service, and Dr. Lorraine Zinn, an adult education specialist of Lifelong Learning Options in Boulder, Colorado.

The second session was held on October 10-12, 1995, at the Krooked River Ranch, near Haskell, Texas. This session discussed how:

1.) Range inventory and monitoring techniques are utilized to set and adjust stocking rates.

2.) Habitat requirements for different wildlife species and how range management practices and livestock grazing can influence habitat diversity and populations.

3) Prescribed burning can be utilized to support and promote sustainable grazing systems.

Instructors included J. F. Cadenhead and Richard R. Riddle of the Texas Agricultural Extension Service in Vernon, Texas, Dr. Dale Rollins, extension wildlife management specialist from San Angelo, Texas, Dan Caudle and Reggie Quiett of the Natural Resources Conservation Service (USDA-NRCS), Craig Winters, wildlife manager for the Nail Ranch in Albany, Texas, Drs. Jim Ansley, Bill Pinchak and Richard Teague of the Texas Agricultural Experiment Station in Vernon, Texas, and Dr. Lorraine Zinn of Lifelong Learning Options in Boulder, Colorado.

The third workshop session was held March 19-21, 1996 on the Waggoner Ranch near Vernon, Texas. This session emphasized the integration of grazing management systems with prescribed fire as a major tool in the manipulation of brush and noxious weeds. Agents examine different grazing systems, constructed a fire plan, and conducted an actual prescribed burn on rangelands.

During the first two sessions, Dr. Zinn served as an instructor as well as a critic of the program. Dr. Zinn taught several sections dealing with adult education and demonstrated to the participants how they may utilize the information gained from the work-

Project area
Training

Project duration
March 1994-Dec. 1996

Budget:

SARE	$ 72,570
ACE Matching	$ 72,570

shop sessions to better serve the producers within their own counties. Dr. Zinn was also instrumental in helping to set up an evaluation form for both sessions. These evaluations were used to determine how the agents felt about various sections of the workshops, as well as the program as a whole. Dr. Zinn summarized the evaluations and made suggestions as cooperators planned future sessions and workshops.

Results

The evaluations determined that the agents responded much more favorably to hands-on learning experiences, as opposed to lecture-style work sessions. Therefore, as they planned the second and third sessions, more field exercises, ranch visits, and realistic problems were added to the schedule. This produced a very positive response from all participants.

Evaluations received at the conclusion of the third workshop showed an overall program rating of a 4.22 out of a total possible 5 (scale of 0=not applicable to 5=excellent) for a percent score of 84.4%. As expected, the outdoor sessions on conducting an actual burn rated the highest, with a 4.78% score or 95.6% approval rating. The economics session on whether or not one could make the management system pay received a score of 4.44 out of 5 for a percent score of 88.8%.

Of special interest to workshop sponsors and instructors was the rating of "usefulness of the program's information to clientele in your community" (people back home). This was a measure of the degree to which trainees perceived their clientele would or could use the information in real life situations. The score averaged a 3.89 out of 5 possible, for a percentage of 77.8%. It was also to some degree, an indication of the importance of the information the agents believed they received. It was not a measure of the percentage of trainees (agents) that planned to use the information once they returned home.

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LST94-3
LST-96-9
Annual Report
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Management Intensive Grazing: Foundation of Sustainable Agriculture in the South

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Project area
Training

Project duration
July 1994-Dec. 1998

Budget:
SARE $ 97,223
ACE
Matching $ 109,463

Objectives

The objectives of this project are to provide comprehensive management intensive grazing (MIG) to national Cooperative Extension Service (NCES), Natural Resource Conservation Service (NRCS) personnel, and innovative livestock producers stationed in the humid, temperate and subtropical Gulf South through a training project. Specifically:

1.) Demonstrate via lectures and hands-on field training the economic, environmental and agricultural benefits of MIG relative to conventional agriculture.

2.) Illustrate the role of MIG in comprehensive sustainable agriculture planning,

3.) Train participants to assess farm suitability (soils, pastures, building, equipment) for MIG,

4.) Train participants how to teach field management to other farmers,

5.) Develop and distribute training videos that will supplement participant knowledge,

6.) Develop and distribute fact sheets on MIG in the South for use by participants and clientele.

Methods

Workshops were conducted in April, May and September 1995 to train participants in management intensive grazing. Participants included producers and Natural Resource Conservation Service personnel from Louisiana, Arkansas, Mississippi, Texas, Georgia and Alabama with one Cooperative Extension Service agent from Kentucky and one from Louisiana. The workshops were conducted for three days with both classroom and field sessions.

The itinerary included as oral presentations in the classroom:

*The science and art of grazing management
*Environmental management
*Plant growth basics: energy flows, nutrient cycling, fundamentals of growth
*Understanding soils and the landscape
*Resources of the farm
*Economics of management intensive grazing
*Forage quality, animal requirements and intake
*Meeting nutritional needs of livestock
*Matching livestock and forage resources
*Forage system strategies for year-round nutrition.
*Controlled rotational grazing: putting it all together
*MIG on my farm
*Grazing Land Applications and nutrition balance

Field demonstrations with hands-on experiences included:

*Participant groups grazing demonstration
*Biodiversity
*Water systems
*Keeping pasture records
*Forage quality
*Field pasture assessment
*Forage harvest efficiency
*Fencing equipment
*Forages for year-round grazing
*Soils in the field
*Quantity measurement and species identification

Fact sheets have been written and included in a notebook for each participant with titles:

**The role of ruminant animals in sustainable agriculture*
**The forage growth and its relationship to grazing management*
**Understanding soils and land scapes*
**Estimating forage yield*
**Grazing dynamics of beef cattle*
**Proper grazing use*
**Fringe benefits of rotational grazing*
**Economics of management intensive grazing*
**Forage management, practical applications*
**Determining winter pasture stocking rates*
**No substitute for good management*

Results

Participants have been surveyed to de-

termine constraints against establishing intensive grazing management. Personal management expertise of livestock and forages are always listed as the first constraints followed by fencing systems and operating capital with soil fertility, water availability, and livestock working facilities being less important. Producers indicate the consideration of implementing MIG is the result of a need for improvement in sustainability. This list shows these changes include increasing utilization of existing forage, livestock numbers (carrying capacity), grazing efficiency, economics of livestock operation, milk production, animal control while decreasing labor and input costs and the amount of field work.

Technical personnel have listed priority areas for training in MIG as:

1.) Knowledge of intensive management systems in general,

2.) Fencing, water and shade requirements,

3.) Forage species selection and management, and

4.) Bridging the summer production slump.

The technical personnel attending these workshops have indicated that they were not able to adequately answer producers questions concerning intensive grazing. All participants were asked if their perception of the importance of the topics listed as constraints had changed during the course of the workshop. Forage management, water availability, manure management and environmental quality issues were the constraints listed with the highest priorities.

Responses by participants indicated an increased need for training in Management Intensive Grazing with increased involvement by Extension and NRCS personnel with producers who are participating in sustainable agriculture programs. Follow up surveys will be conducted to evaluate the level of MIG participation by trainers and the degree of implementation by producers. A video on MIG is currently being produced. This video would be beneficial to trainers as well as producers interested in MIG practices.

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Sustainable Dairy Systems Manual and Training

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Cooperators continued on next page

Dairy farming is a significant and dramatically changing part of agriculture. This change is occurring in production systems, investment requirements, environmental concerns and the need for enhanced overall business management. Extension services in Tennessee and Kentucky are cooperating in preparing, pilot teaching and evaluating an interdisciplinary dairy systems costs, returns and production requirements manual and computerized data base. Farmers, agricultural organizations and rural leaders in Tennessee and Kentucky are actively involved in the development, evaluation and use of the training materials. The SARE/ACE program has invested in this project to enhance the sustainability of dairy farms.

Objectives

1.) Prepare, pilot teach and evaluate a dairy systems manual and computerized whole farm planning data base for the Southern region.

2.) Develop and prepare teaching materials on technical production relationships and costs and returns for appropriate crop and livestock enterprises including facilities, machinery investment and labor requirements for alternative technologies.

3.) Train Extension agents in Kentucky and Tennessee to use and teach from the manual and conduct educational programs with at least 500 farm families with dairies.

4.) Use the systems manual and computerized data base to develop intensive farm and financial plans with at least 110 Kentucky and Tennessee farm families.

5.) Use the dairy systems manual to teach SCS and ASCS personnel, agricultural lenders and other professional agricultural workers, environmental groups and rural people about sustainable dairy systems.

6.) Use the dairy systems manual to demonstrate to others the importance of a systems approach to management.

Approach

Farmers and Extension agents in Tennessee and Kentucky identified relevant issues addressed in this project. From the beginning, project output was driven by perceived needs expressed by agents and farmers. Over a two-year period, a 25-member work team of agronomists, economists, Extension agents, engineers, and dairy specialists, along with farmer advisers from Kentucky and Tennessee, are preparing, pilot teaching, and evaluating a dairy systems manual and user-friendly computerized spreadsheets.

Results

The project started in August 1994. The seventeenth and final copy of the manual was released in February 1997. Systems have been developed for dairy herd sizes ranging from 50 to 800 cows. The systems approach is being used directly in developing actual farm plans with Tennessee and Kentucky dairy farmers.

The approved systems manual proposal included six chapters on forage systems, feeding systems, manure management systems, milking centers, and a chapter combining all phases of the dairy farm into a system. Environmental and sustainability concerns are being incorporated into the systems process. As the project progressed, the work team added six additional chapters. The manual addresses management information and decision support, farmstead planning, dry cow housing, feeding and management, replacement heifer housing, feeding and management, milking herd feeding and housing facilities, and additional inputs. Extension personnel in Tennessee and Kentucky have used the manual in conducting educational programs with at least 500 Tennessee and Kentucky farm families. Intensive training was conducted with extension agents in March and December 1996. Their evaluations and recommendations are being incorporated into the final manual.

Written evaluations by Tennessee and Kentucky Extension personnel and farmers participating in intensive three-day dairy systems training workshops revealed the following level of achievement:

Ninety-two percent (92%) of the participants indicated the level of detail in the

Project area
Training

Project duration
March 1994-Dec. 1997

Budget:

SARE	$90,000
ACE	
Matching	$277,920

manual was about right.

One hundred percent (100%) of the participants stated the manual was very well or adequately organized. Fifty-three (53%) percent indicated the manual was very well organized. Ninety-seven percent (97%) of the participants stated their knowledge level was improved by either a 4 or 5 on a 5-point scale.

One hundred percent (100%) of the participants rated the overall effectiveness of the manual and software workshop as either a 5 or 4 with an average score of 4.5 with 5 being excellent and 1 poor.

Evaluations of training sessions indicate likely effectiveness of the manual and software in working with dairy farm families. This innovative educational tool promises to make a major difference in the lives of dairy farm families.

Impact of results

Educational materials developed in this project are a critical component in an overall management educational program. Properly combining the expertise of appropriate subject matter specialists, researchers, and farmers to identify interrelationships and results of various decisions will dramatically affect the future of dairy farm families. Plans are to continue to aggressively use the finalized dairy systems manual and spreadsheets with additional dairy farm families.

Potential contribution

The dairy systems program has demonstrated to others the importance of a systems approach to management. This should encourage leaders in other commodity areas to consider using this approach. Lessons learned and portions of the teaching material developed in the dairy systems manual will be useful in future work directed at other types of farms. A major benefit of this program is the professional growth experienced by the 25-member team of economists, engineers, agronomists, animal scientists, agents, and area specialists. Working together as a team in putting together a total interactive system has improved the ability of each "specialist" to look at the often complex total picture instead of focusing only on a small part of the issue.

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Sustainable Cotton Production for the South

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The 1996 centennial of Alabama's Old Rotation (circa 1896) experiment marked a milestone in the use of winter legumes (annual clovers and vetch) as a source of nitrogen for nonleguminous cash crops such as cotton and corn. The Old Rotation is the world's oldest, continuous cotton experiment and the third oldest field crop experiment in the United States on the same site.

When it was started in 1896, its primary purpose was to determine the effect of crop rotations and winter legumes on sustainable production of cotton in the southern U.S. However, growers, for whatever reason, have been reluctant to adopt these well demonstrated, sustainable practices which protect the soil from winter erosion and add N to the soil. Perhaps inexpensive N fertilizers, traditional tillage practices and the nature of the growers winter legumes have made this practice unattractive.

Objectives

1.) Use the concepts of sustainability as illustrated in the 98-year Old Rotation to conduct on-farm sustainable cotton production demonstrations.

2.) Prepare research bulletins and popular brochures on the benefits of sustainability as demonstrated by 98 years of continuous, sustainable cotton production and on-farm demonstrations.

3.) Compute cotton sustainability and total social factor productivity indices in order to assess the ability of cotton to remain a viable economical and environmentally compatible crop for Alabama.

4.) Conduct workshops for county agents, providing training necessary to conduct on-farm sustainable production demonstrations.

Approach

An extensive demonstration of new legumes as a source of N for cotton was established in Central Alabama in the fall of 1995 and will continue through 1997. This site was a feature in the 1996 Central Alabama cotton tour where more than 100 growers participated.

Results

The results from this replicated demonstration indicated that legumes were just as effective as the recommended rate of fertilizer N on seed cotton yields. The new legumes do not appear to be any better than the older ones such as hairy vetch in sustaining cotton yields. Three additional on-farm demonstrations were established in the fall of 1996.

Impact of Results

A seminar and a one-day symposium celebrating 100 years of sustainable cotton production in the South was held on the campus of Auburn University in conjunction with the centennial of the Old Rotation. Speakers from England (Rothamsted Experiment Station), Illinois, Missouri, and Oklahoma complemented presentations from Alabama research and extension programs. More than 100 growers, researchers, extension specialists and agribusiness leaders attended the program which included tours of long-term cotton and winter legume plots. This complemented four in-service training sessions held around the state in 1996 on sustainable agricultural systems.

Analysis of long-term data provides convincing evidence that continued use of winter legumes with or without crop rotations in a cotton production system can improve soil quality as measured by soil organic matter. Cotton yields are highly significantly related to soil organic matter.

Project area
Training

Project duration
March 1994-Dec. 1996

Budget:

SARE	$ 10,000
ACE	
Matching	$ 11,898

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LST94-7
Final Report
December 1996

Evaluating Sustainability: Gaining Insights

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The Southern Regional Training Workshop, Evaluating Sustainability, was a collaborative effort of six institutions: the University of Arkansas at Pine Bluff, Auburn University, Clemson University, the University of Florida, the University of Kentucky, and South Carolina State University.

Objectives

The workshop had four main objectives:

1.) Provide participants with an understanding of the multi-faceted nature of sustainability.

2.) Permit participants to use a variety of tools and approaches to evaluate the sustainability of agricultural production systems.

3.) Give participants an opportunity to apply a range of tools in classroom case studies and on-farm studies to determine the utility of these tools in the participants' own work situations.

4.) Permit participants to exchange experiences and share information with each other.

Approach

Five modules were included in the workshop:

1.) Biodiversity;
2.) Conserving Soil Resources;
3.) Money Matters;
4.) Energy, the hidden input;
5.) Water Quality.

The workshop was designed to bring together a diverse audience and provide an opportunity for participants to explore their differences and agreements about the goals of sustainability, how to move toward more sustainable agroecosystems, and how to progress toward sustainability. The learning/teaching philosophy was based on participatory adult learning.

Acting on the call of many in the sustainable agriculture movement, the course moved beyond philosophical discussions of "the meaning of sustainability" and beyond "how to" or "recipe" approaches designed to address specific production problems. Rather, it provided a framework for diverse people, including environmentalists, farmers, extension personnel, elected officials, teachers, and others to come together to agree, disagree, and move toward consensus on goals for the sustainability of agriculture.

A hands-on learning approach was emphasized. Many different activities were included during the two and one-half day workshop. These included:

1.) Videos with an interactive component.
2.) Background reading materials.
3.) Classroom exercises.
4.) Small or local group discussions.
5.) Field studies.
6.) Teleconference large group discussions.

This mix of activities was designed to accommodate the many different learning styles of adults and to help participants "close the learning cycle" by moving from effective learning to application to abstract concepts to on-the-job applications.

Results from the pre- and post-tests of knowledge and attitudes and from the process evaluations conducted at the workshop sites indicate that this learning approach was successful. The primary objective of the pre-post test of knowledge and skills was to determine whether participants learned new skills, gained new knowledge or changed their attitudes about sustainability as a result of the workshop. Analysis of test results show that in four of five modules there is a 95 percent probability that learning objectives were met. The same is true for the workshop as a whole. Conserving Soil Resources is the exception. In this case, the probability is only 86 percent that learning objectives were met. Over 68 percent of the participants felt that they had mastered the four main objectives of the workshop and could use the tools in their work.

Results from the process evaluations of the workshop are similar. Participants were asked how well each of the four workshop objectives described above were met. They responded on a scale of one (not at all) to four (completely). All participants indicated that workshops objectives were met to some degree.

Lower satisfaction was apparent for objective 2 (tools for evaluating sustainability), where 19 percent indicated that they met this objective only somewhat (score of 2).

Project area
Training

Project duration
March 1994-Dec. 1996

Budget:
SARE $56,269
ACE
Matching $13,467

Overall, however, almost all participants ranked satisfaction as "3" or "4". For example, 62 and 72 percent, ranked their satisfaction with objectives one (nature of sustainability) and three (classroom and field use of tools) as "almost entirely met" (score of 3). Almost all, 72 percent, indicated a score of four (completely) for objective four (participant exchange).

A telephone follow-up survey conducted eight months after the workshop indicated that participants felt that the workshop was beneficial, interesting, informative and enjoyable. According to one respondent, it "increased my knowledge in a nutshell." Participants listed the diverse interchange with colleagues from many different branches of agriculture as a long lasting benefit of the workshop. Although many participants indicated they valued sustainable agriculture prior to the workshop, several felt participation reinforced or enhanced their understanding of the subject, reminding them that sustainable agriculture is not limited to organic farming and gave them a bigger picture of the impact of agricultural production.

Nearly all of the respondents said they had shared and used the information with coworkers, middle school students, cooperatives, farm bureaus, nonprofit organizations and farmer via face-to-face discussions, training sessions and farmer demonstrations. Information gained in the workshop was also incorporated into grant proposals, state-wide agricultural plans and extension in-service events. The materials developed for this workshop were used as the core of a graduate level course offered via the Internet for secondary teachers, 4-H and extension professionals and students at five institutions in the Southern region.

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Sustainable Small-Scale Agricultural Development Training Project

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Southern University, Heifer Project International (HPI) and Zachary Community Cattle Enterprise are sponsoring two workshops on sustainable agricultural and community development. The first workshop will be held in Arkansas in February 10-13,1997, and the second in Louisiana, May 21-23, 1997.

This unique, dual workshop program is intended specially for farmers, cooperative extension agents, Natural Resource Conservation Service staff, Community Development outreach and others who work directly with farmers and ranchers.

Objectives

The program is designed to help participants become more effective encouragers of sustainable agricultural and community development where they work and live. Participants are expected to become a qualified cadre of professional agricultural workers who understand sustainable agricultural models, practices and concepts that are relevant to successful small-scale farming. They are expected to develop an appreciation for external factors such as viable small communities, local markets, and employment opportunities that contribute to sustainable small-scale farming. Benefits of regional collaboration would include increased networking capabilities, greater focuses on issues relevant to small farmers in the south, and a much wider discrimination of information.

The specific objectives of the program are for the targeted audience to:

1.) Become aware of and understand the appropriate use of the various small scale sustainable agricultural models that are based on holistic approaches (production, management, and marketing).

2.) Acquire the necessary skills to work with grassroots groups, through the use of a sustainable, holistic planning and management model that includes, leadership development, strategic planning and evaluation, and communicating and group decision making.

Topics to be covered include: defining and assessing sustainability, holistic, value-based approaches to agricultural community development; how to work with grassroots groups of farm families; facilitating visioning and goal-setting by farm families and grassroots groups; integrating alternative enterprises, unconventional production models, and creative marketing strategies to achieve small farm profitability; monitoring biological and social changes as farmers shift from conventional to more sustainable practices; and putting what you learn into practice when you get back home.

To encourage broad collaboration, the program seeks to have each state in the southern region represented by a team of three people: one farmer who is a leader in their community; one extension agent; and one facilitator of agricultural, rural or community development who works for a non-government organization. Applicants who fit these categories will be selected on a state-by-state basis to create these teams. Members of these teams will be expected to share what they learn as broadly as possible when they return home.

Because these two workshops are designed to complement each other, participants should plan to attend both workshops. Applicants from the Southern Region will receive priority. Others can participate on a space available basis.

Approach

The three-day workshop at HPI's International Learning and Livestock Center, in Perryville, Arkansas, February 10-13, 1997, will be conducted using HPI's values-based planning, management, monitoring, and evaluation. An overview of the HPI's value-based planning and management model will be given. Participants will have the opportunity to learn how to apply the model to their own situations.

The workshop will also cover techniques for participatory team building and working with grassroots groups in fun and innovative ways. Participants will walk the educational trail through HPI's Global Village and thoroughly examine the essential components of sustainability and small farm profitability.

The HPI approach to rural empowerment through the distribution and sharing of live-

Project area
Training

Project duration
October 1995-October 1997

Budget:

SARE	$25,701
ACE	
Matching	$25,701

stock with cooperating self-help community organizations will be emphasized.

The second workshop, led by Southern University, Baton Rouge, Louisiana, May 21-23, 1997, will consist of a comprehensive small scale agriculture program that includes livestock, vegetables and alternative agricultural enterprises. Participants will be exposed to various integrated enterprise models that incorporate production, management and marketing components. The importance of marketing will be stressed throughout the workshop.

Highlights of the workshop will include an overview of marketing concepts and strategies. An expert panel discussion of successful direct marketing models for small scale farmers, and a half-day tour of the University Small Farm Family Resource Development Center are other features of the workshop.

Other operations include small-scale sustainable farming demonstrations with cattle, sheep, goats, pigs, poultry, rabbits, bees, and fish. Additionally, the HPI model for rural empowerment through the distribution and sharing of livestock with cooperating self-help community organizations will be emphasized.

Participants will be provided with an evaluation instrument, and all aspects of the program will be evaluated for worthiness and applicability. A joint HPI/SU publication of the proceedings will be compiled and distributed following the completion of the workshops. The proceedings will be published in a handbook (primer) that can be used by extension personnel and other agricultural professionals to highlight the presentations, findings and recommendations resulting from this project. Additionally, participants will be contacted using a recommended random approach approximately six months after the workshops to determine individuals' application of the information gathered.

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Southern Gathering on Agricultural Problem Solving

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The goal of the Southern Gatherings on Agricultural Problem Solving is to build community capacity to recognize and manage change. Rural agricultural communities face pressures to increase farm profitability, reduce environmental impact of production, respond to changes in farm policy, compensate for economic fluctuations and manage development. As individuals choose their own responses to these pressures, the cost may be the weakening of the community as a whole. How can we help sustain communitiesin the face of change?

Objectives

1.) Increase the capacity of agricultural communities to deal with change by training community members in public deliberation, conflict resolution and strategic planning.

2.) Involve extension professionals, other farm service institutions, public media, and farm families in the development and delivery of curricula on issues deliberation, strategic planning, and conflict resolution. Strengthen the ability of cooperative extension to provide these skills by creating county teaching teams of extension agents who participate in the planning of the training, and then carry out the training at the gathering.

3.) Solicit balanced participation by diverse farm community sectors, with attention to gender, race, farm related income, disability, and other relevant demographic characteristics to simulate the diversity of real communities.

4.) Develop participant ability to apply methods of problem-solving toagricultural and broader-based community issues.

5.) Cooperate with the Kentucky Leadership for Agricultural and Environmental Sustainability (KLAES) Project, the University of Kentucky Agriculture 2000 Project, and the National Issues Forum initiative of the Kettering Foundation to achieve synergism between development program.

6.) Bring about change in farm community agendas, production and marketing practices, and farm community infrastructure through application of concepts by workshop participants.

7.) Evaluate the workshop efforts focusing on changes in knowledge, opinions, skills, and aspirations.

Approach

Each of the annual Southern Gatherings on Agricultural Problem-Solving offers three learning tracks: 1) public issues deliberation; 2) conflict resolution; and 3) strategic planning. Farmers, extension agents, agricultural and environmental leaders and others choose one of these three tracks. Plenary sessions draw common themes and lessons from each of these problem-solving approaches and suggest ways to integrate associated activities into public issues educations work and policy formation.

The public issues deliberation approach builds on the work of the Kettering Foundation's National Issues Forum Summer Policy Institutes and involves some of the Kettering National Faculty. Participants in the public deliberation workshops learn to lead healthy and deliberative discussions about controversial community and agricultural issues.

The approach to conflict resolution is based on widely used principles of interest-based problem-solving and negotiation as they have been adapted and taught in training sessions for agricultural audiences by Dr. Ronald Hustedde of the University of Kentucky. Participants gain skills and experience through instruction, role-playing and case examples with agricultural themes.

The strategic planning track concentrates on building shared visions that involve a wide range of issue stakeholders, moving from shared vision to planning and implementation, and evaluation of outcomes.

Results

The first Southern Gathering on Agricultural Problem-Solving took place October 9-11, 1996, at the Rural Economic Development Center in Somerset Kentucky. More than 120 participants representing 12 states and many communities were actively involved in the conference. Those who took part in the planning, delivery, and evaluation of training included extension personnel from the University of Kentucky,county

Project area
Training

Project duration
August 1996-Sept. 1998

Budget:

SARE	$52,000
ACE	
Matching	$52,000

extension teams from Pulaski County, Crittenden County, and Madison County, Kentucky, several members of the Kettering National Faculty, James Goode of the Appalachian Center at the University of Kentucky, staff of the Center for Sustainable Systems, representatives of the Community Farm Alliance, Dr. Jim Worstell of Delta Land and Community, Inc., and participants in the KLAES project. Feedback on the workshops and plenary sessions was generally positive with most participants finding the sessions useful and applicable to situations in their home communities.

Plans for Rmainder of Project

Two more gatherings are planned, the next to be held November 5-7, 1997 at the Center for Rural Economic Development in Somerset, Kentucky. Recruiting for the 1997 conference will focus on community teams who come with a pre-defined community issue or problem to work on. Planning teams are currently working on refining the three workshop tracks and an expanded plenary framework for the second gathering.

Additional plans include follow-up with participants to document application of workshop skills and define needs for additional training. A third gathering is planned for 1998.

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Annual Report
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Facilitating Farmer to Famer Networks: An Experimental Approach

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Objectives

This project is training county extension faculty and farmer leaders how to build grassroots organizations. It focuses on Florida's 30,000 small farms and their needs, but has training implications for the entire region.

Approach

Project activities began with identifying several fledgling networks for small-farm owners interested in sustainable methods. In September 1996, six were chosen to participate in the two-year project. Each of the chosen networks designated an extension agent and two farmers to serve as liaisons for the project. For one year, the representatives are receiving training in basic sustainable ag concepts as well as leadership development and group processes. Since the type of farming varies widely among the groups, additional training topics are being determined by the needs of each group.

The groups do not share a common focus. The Marion County Small Farm Association, for example, consists largely of part time farmers in animal production from beef cattle to ostriches and emus to rabbits. A group in the Suwannee Valley shares a common interest in vegetable crops, ranging from non-traditional crops such as oriental vegetables to traditional Suwannee Valley products, such as sweet potatoes.

Farmers in the Tampa Bay area share no common interest in terms of farm enterprises, but do share a common interest in developing direct marketing approaches for the products from their farms.

Results

Despite this variety of interests, two clear themes have emerged. First, the local organizations have identified market constraints as their major concern. Therefore, many of their training program and action plans focus on marketing and value-added product development.

Second, leadership and management skills are also emerging as constraints for small farmers, both the skills needed to run individual farms, but perhaps more importantly, the skills that make farmers' organizations work. The training program and action plans are, therefore, developing specific local activities in these areas.

Plans for Remainder of Project

Along with formal training, the representatives will be provided with a workshop in July 1997, where successful farmer networks will share their experiences. Then two project assistants will be assigned to each group. During the training year they are developing materials, gathering information, overseeing the self-evaluation process and facilitating the networking activities.

At a wrap-up workshop each group will be presented and analyzed by all the participants. Based on this workshop, the project leaders will develop a handbook that summarizes and analyzes the different approaches used in the training year. The handbook will be available to farmers and other agricultural professionals in the Southern Region.

To further multiply the effect of this training, it is hoped that the networks from the project will eventually come together to create a statewide organization for sustainable agriculture in Florida.

Project area
Training

Project duration
Marc 1996-October 1997

Budget:

SARE	$80,997
ACE	
Matching	$80,997

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December 1996

Sustainable Agricultural Marketing Through Collaborative Policy Development

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When you find yourself in a situation where uncertainty is high, things are so complex they seem chaotic, and polarization is rife—and you can't just leave—what do you do? Those interested in the interaction of nature with farms and forests can find themselves in an infinity of such tight places. Environmental policy debates related to agriculture seem to almost always have these characteristics. Agricultural marketing policy, however, is increasingly even more polarized, uncertain and complex.

Creation of sustainable marketing alternatives is an extremely important research and education topic, but extremely difficult to approach by traditional methods. However, policy change in some states has been successful in helping farmers create such alternatives.

The funding which states can make available to create new marketing alternatives make the funding from SARE pale in comparison. Texas alone has a $225 million fund for agricultural value-added enterprises, created by citizen initiative.

Outside the South, Minnesota and Kansas have created independent non-profit corporations (Agricultural Research Utilization Institute—AURI and Kansas Value-Added Center—KVAC) to provide research for businesses and farmers in product development, organizing new enterprises and feasibility analysis. (AURI has helped develop 190 new products and over 100 successful businesses.) Due to these efforts, millions more dollars every year are invested in applied agricultural research in those states.

One of the most successful programs for helping farmers create their own new value-added enterprises is the Agricultural Products Utilization Commission (APUC) in North Dakota. Over 30 new cooperatives are creating new marketing opportunities for farmers thanks to start-up support from APUC. The first was the Dakota Growers Pasta Cooperative which has over a thousand members, a $41 million facility, and has returned millions of dollars in profits to the farmer-owners. Iowa in 1994 established a program based on APUC and AURI which is supported by $4 million a year from the state road tax.

Creating the New Wave of state alternative marketing policies. Working for policy change is often difficult and frustrating. A method successful in environmental issues and in APUC's development is being applied by this project in value-added/diversification efforts in the South.

The method is illustrated by an environmental example. Two polarized positions had developed in the environmental and agricultural communities regarding non-point source pollution of groundwater in Kentucky. The controversy came to a head when the Kentucky Environmental Protection's Division of Water proposed new groundwater protection rules which would require every farmer to prove he is not a polluter at a cost estimated of $30,000 per farm. This led to a state-wide protest by farmers. The power of farm organizations led environmentalists to fear that all efforts to protect the environment would be damaged.

To resolve the situation, a group was convened with both farmer and environmentalist representatives along with other industries affecting groundwater. Employing our "construct group" method enabled environmentalists to agree that family farms should be preserved while farm representatives agreed that no willful polluter of groundwater should be defended by the agricultural community.

Continuing application of our method created a policy environment which enabled passage of nationally innovative legislation which established the Kentucky Agricultural Water Quality Authority where farmers and environmentalists jointly develop and improve all surface and groundwater regulations and practices.

The key to this successful process is first, uncovering the basic assumptions which enable people to be absolutely convinced they are right no matter what the evidence, and then, establishing even more basic stabilizing assumptions which can be agreed to by both polarized groups. Then both previously

Project area
Training

Project duration
April 1996 - Dec. 1997

Budget:
SARE $40,900
ACE
Matching $34,000

polarized groups can participate in synthesizing a new approach on this common foundation. Delta Land and Community is now applying the process to issues of sustainable rural development in the Delta.

Objectives

Participants will design cost effective agricultural value-added marketing options tailored to their state and a policy education/research process to refine and implement the options.

A hands-on manual based on these methods and tailored to local policy education/research on diversification/value-added marketing will be created and field-tested in multiple states including Kentucky, Tennessee and Arkansas.

Approach

The construct group is created to explore systems constraints and opportunities. Participants synthesize unique and motivating plans for policy activities. Construct groups and similar methods have proven to be effective tools for influencing agricultural policy in several U.S. states and Australia.

The objective of such groups is to achieve a creative synthesis of ideas and build consensus on priorities for action. Following is a detailed discussion of a specific use of the approach.

Facilitators of such groups adopt an attitude or stance where there is no expert, no student, no we, no them; where "we can all learn something from each other"; and where the ways of thinking which are most crucial to understand are those of the managers of the systems: the farmers, agribusinessmen, the legislators.

In all parts of the South extension, NRCS, and other change agents often feel pressed to be the expert in every field. The focus team approach provides another professional role for agents. By acting as a facilitator, the agent can take a more neutral stance between differing perspectives and different sources of information. The construct group process sets up a co-learning environment where everyone recognizes they can learn something from everyone else. The farmer has much to offer, as do the researcher and the businessman and legislator.

However, construct teams go far beyond sharing information and perspectives. The facilitator in this approach does not just ease the flow of information between differing perspectives. Rather, as an integrating facilitator, the local agent uses the raw data of differing information and perspectives to create a consensus conceptualization of a particular problem space. In group meetings, this is done by separating brainstorming from priority setting and between the two sessions recruiting group "leaders" (who emerge as adept at integrating in the brainstorming session) to help group and summarize the ideas, information and perspectives which emerged.

The facilitator helps the group to establish a systems perspective, a key part of which is looking for feedback loops—both inside the system and between the system and other systems outside it.

A basic goal of the method is a qualitative one—achieving synthesis of perspectives or paradigms. Success can be inferred from the establishment of state, agroecoregion and local teams across ideological boundaries devoted to creation of southern agricultural systems which are productive, supportive of rural communities, profitable for farmers and environmentally sound.

Results

A series of workshops have been held in four states which have successfully recruited prominent local businessmen, farmers, USDA staff, legislators and others to work on policy change in diversification/value-added marketing. The project has also assisted specific enterprises which have joined the effort, including community enterprises based on organic cotton, high oil corn, biocontrol, organic poultry, meadowfoam and kenaf.

The project has also brought state officials and DEN members from four states together to exchange ideas about creation of value-added enterprises. Many of the participants had never before met one another, but have now already met back in their own state capitals to hammer out legislative means of bringing about change in their states.

Potential Contribuiton

To create more environmentally and economically sound agricultural systems, the crucial need is for facilitators who can help groups integrate production, policy and marketing systems and, from this knowledge, synthesize innovative systems. A foremost task of agricultural colleges should be to create those facilitators. This project is a step toward a curriculum for such facilitators.

Plans for Remainder of Project

As these workshops build on each other, a manual for collaborative policy development will be refined. An attractive summary of this manual will be distributed to every county in Arkansas, Tennessee and Kentucky. Follow-up activities are pledged by the participating agencies to build on successes of the project.

This project is just beginning. Workshops will continue throughout the coming year, many in concert with specific legislative initiatives. Details of the approach are available in the technical report and participation is welcomed from anyone interested in policy change in agricultural marketing and sustainable rural development.

Producer Project Summaries

SARE
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Southern Region

PG94-5
Annual Report
December1996

Vegetable Marketing Strategies for a Small Farm Co-op

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Cooperators

SCSU
Small Farmers Technical Assistance and Training Project

Clemson University
Cooperative Extension Service

In order to succeed, farmers who belong to market co-ops must learn to supply produce year-round. They must also learn to apply techniques and strategies to market that produce. Such techniques and strategies include proper preparation, storage, packing and shipping.

Objectives

1.) Conduct a series of vegetable marketing workshops focusing on readying, transporting and marketing produce to commercial markets.

2.) Evaluate current marketing strategies to determine strengths and weaknesses.

3.) Develop an evaluation/assessment plan to determine the effectiveness of workshops and seminars.

4.) Submit annual reports concerning farmers' attitudes and income gains after applying various marketing strategies and techniques.

5.) Host an annual demonstration marketing field day to include other farmers in the area and other cooperatives.

Approach

During this extended project, leaders are arranging with commercial vendors and agricultural service representatives to provide a co-op of 55 small farms with a series of workshops that focus on techniques for timely production and on preparing, transporting and marketing produce in a more profitable manner.

The project began with a workshop called *Sharing Information About My Farm*, which led co-op farmers to examine the ways they were currently marketing their produce and to note the strengths and weaknesses of those methods. This was followed by workshops entitled *Problems Facing Farmers Today* and *Financial Management Training*. The latter included sessions in computer training for farm management and presentations about sustainable agriculture.

A form is being designed and will be mailed to participants for their evaluation of the effectiveness of the workshops.

Results

Participants report that the workshops have fostered a positive attitude, and they are eager to learn new ways of marketing their produce. They are consulting more with each other about individual crops and about striving for consistent quality in the produce coming from co-op farms.

The computer workshop was particularly popular and has spurred requests for more training in farm record keeping by computer. The co-op is investigating the possibility of purchasing computers for this training.

Results

Results were demonstrated on November 17, 1995, when the farmers put into practice the skills they had learned in the workshops. They pooled produce of consistent quality from their various farms and then loaded trucks to send their first shipment from South Carolina to Baltimore.

Co-op members anticipate that the changes will impact profits, but at this time it is still too early to tell. Future seminars will build on the strengths of the current strategies to develop a progressive marketing program.

Outreach

A total of 40 people attended the 1995 workshops. In October, the first marketing field day was attended by 19 people, including farmers from other communities. It was held at the Joseph Fields farm, which produces squash, strawberries, collards, cabbage and broccoli. The group was given a tour of the farm, which uses a combination of bed and row planting techniques. The pond and irrigation system were included in the tour.

Joseph Fields concentrated on squash for the marketing demonstration. He explained how to grade for color and size. After harvesting, the squash was placed in a wash water containing dish detergent and chlorine bleach. The bleach acted as a cleansing agent and the detergent imparted a shine. The squash was then placed in crates, ready to be transported. He explained that the squash blossoms are sometimes sold as a specialty item. The field day concluded with a meal at the Fields' home, where attendees discussed their own operations and exchanged ideas.

Project area

Marketing

Project duration

3 years

Budget:

SARE	$10,000
ACE	
Matching	$1,850

SARE
Sustainable Agriculture Research and Education
Southern Region

PG94-10
Final Report
December1996

Site Specific Applications of Seed, Fertilizer and Chemicals

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Ronnie Settles
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Although technology now exists to make site specific inputs of seed, fertilizers and chemicals feasible and profitable, field-wide or farm-wide applications are still the norm throughout the South and the rest of the United States. Research has shown that applying these inputs according to soil type and productivity will reduce costs, increase profitability and reduce environmental hazards.

Objectives

1.) Divide and map field areas by soil type.

2.) Obtain soil and plant samples in each mapping unit, and fertilize, plant and apply pesticides as indicated by test results in each mapping unit.

3.) Utilize global positioning systems technology and mapping to maintain site-specific cost, return and environmental records. Monitor water runoff on test areas.

4.) Compare economic, agronomic and environmental data from fields receiving site-specific management to adjoining fields using current practices.

Approach

This project is evaluating the use of site specific inputs on land that is being converted to a no-till operation. A 132-acre portion of a 2,000-acre family farm is being devoted to five crops (corn, grain sorghum, wheat, cotton and soybeans) for the duration of the two-year project. The results will be compared to an adjoining field that is being conventionally farmed to produce the same five crops. If the results indicate that no-till, site specific techniques are more feasible and profitable than conventional methods, the entire farm will be converted to the prescription farm process and technology.

In the no-till site-specific field the following practices were to be used:

1.) Map soils using the AgMapp computer program to show soil types in each crop area.

2.) Sample soils in each crop area.

3.) Fertilize, plant and apply chemicals according to crop and soil type needs.

4.) Gather yields by soil type at harvest.

In both fields the following was to take place:

1.) Monitor crop progress with infra-red photography

2.) Use global positioning systems (GPS) technology, computers and AgMapp system to ensure accuracy of all operations.

3.) Monitor water runoff for environmental impact.

4) Record cost and return data.

The first year of the project (1995) the maps were made under the direction of a soil consultant. On the maps the producer can see each soil type and what sections of his field are in that soil type. He can also use the information from the map to correlate the data on seeding rates, treatments and harvest with soil types.

In 1995, the plantings of corn and soybeans were ruined by excessive rainfall. The cotton was ruined by herbicide drift from a neighboring farm. The grain sorghum was affected by excessive heat and drought, making the summer season a major loss.

The grower had problems with both weather and technology in 1996. While he was able to harvest milo and cotton, he was unable to utilize the GPS technology. The major problem was that his equipment, the equipment used by his neighbors who help him, and the equipment of a contractor, could not be easily or inexpensively fitted with the GPS equipment. Compounding this problem was the fact that during the life of the project, evolving GPS technology made it difficult to obtain specifications prior to delivery and interfered with the delivery of the GPS equipment.

Consequently, this grower was not able to utilize GPS technology on his farm. He strongly believes that the technology has potential despite the weather problems and prohibitive equipment cost that prevented his use of it.

Outreach

Even though the project wasn't completed, the grower did learn a great deal about GPS technology. He has been relating his experiences to other growers, emphasizing the factors they need to consider in order to utilize the technology.

Project area

Cropping systems

Project duration

2 years

Budget:

SARE	$10,000
ACE	
Matching	$20,900

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Southern Region

PG94-11
Final Report
December1996

Clover Clippings as Replacement for Chicken Litter in Compost

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One of the elements of sustainable agriculture is reduction or elimination of off-farm inputs while maintaining soil productivity. A four-acre organic garden in Alabama has been enriching its soil with living mulches of clover and with compost which has depended on purchased chicken litter as the main nitrogen source. For a number of reasons the owners are questioning the sustainability of purchased chicken litter in their organic production system. The reasons include contamination risks, economic feasibility, and transportation problems. The growers speculated that they could mow the clover living mulch and use those nitrogen-rich clippings to replace the chicken litter in their compost.

Objectives

1.) Compare clover clippings with poultry litter as a nitrogen source for compost in terms of handling, cost and quality of compost as a complete fertilizer for organic vegetable production.

2.) Determine the best carbon source for use in clover compost.

3.) Determine if the fertility needs of a vegetable garden can be met by mowing and composting the clippings from a living mulch of white dutch clover growing in 2½-foot strips between the three- foot vegetable beds.

4.) Host a field day to demonstrate clover composting to other growers and agriculturalists.

Approach

The project evaluated the use of clover clippings to replace chicken litter as the nitrogen source in compost. Normally the entire garden is planted with white dutch clover. At planting time the growers tilled the clover into the beds but left it growing in the walkways where it protects the soil from erosion and compaction, retains moisture, provides habitat for beneficial insects, suppresses weeds and adds nitrogen and organic matter. They fertilized the crops with compost made from organic matter (including clover clippings) produced on the farm and compared it with compost made from purchased chicken litter.

Comparable compost piles were maintained for one year. Some compost piles were made with chicken litter. The nitrogen source for the other compost piles was clover clippings. The goal was to produce soil fertile enough to grow vegetables without the use of off-farm nitrogen.

The study began in spring of 1995 when the clover was mowed, collected and piled for composting. A total of six compost piles were constructed: four using clover as the main nitrogen source and three using chicken litter:

Chicken litter/ dried grass clippings, vegetable waste, straw, other garden waste

Clover/ dried grass clippings, vegetable waste, straw, other garden waste

Clover/straw

Chicken litter/ pine sawdust

Clover/ pine sawdust

Chicken litter/ hardwood sawdust

Clover/ hardwood sawdust

Project investigators identified several differences in making compost with clover versus chicken litter. From a cost standpoint, the chicken litter must be purchased, while the clover requires only the labor to mow it. For two compost piles of comparable initial size, the costs were approximately $30 for a four-cubic-yard load of chicken litter as compared to $32 for four hours (at $8/hr.) of mowing clover. The project farm is located in an area where chicken litter is readily available; the price might vary in other communities.

The piles were built by one or two people working on the ground with pitchforks and one person on a tractor equipped with a front-end loader. They discovered that the clover requires more pitchfork mixing than the chicken litter, which can largely be handled by the front-end loader. Subsequent turning of both piles is done with the front-end loader.

Making compost with clover clippings must be done within a limited time in early summer, which is already a very busy time for farmers. Once mowed the clippings quickly turn to slime if not combined with carbonaceous materials. The chicken litter may be stockpiled and used at a less busy time.

On this farm the clover provides benefi-

Project area

Organic vegetable production

Project duration

2 years

Budget:

SARE	$6,160
ACE	
Matching	$6,040

cial insect habitat, protects the soil from erosion and compaction and suppresses weeds. Harvesting nitrogen by mowing the clover is considered a bonus, since the clover requires occasional mowing .For the growers the benefits of clover outweigh the advantages that the chicken litter has in terms of cost and ease of handling.

Results

The compost piles were overwintered under fabric covers. Tests were conducted in June 1996 to determine amounts of macro- and micronutrients and organic matter in the finished compost. In experimenting with different carbonaceous materials the growers discovered that the hardwood sawdust immobilized nitrogen to the extent that it took much longer than the other piles to decompose. The hardwood sawdust piles were not analyzed for nutrients because they were not ready at the time of analysis.

The nutrient values of the compost piles made with a variety of carbonaceous materials were much higher than the other piles made with single ingredient carbon sources. Consequently, these compost piles made with clover or chicken litter will be the ones discussed below. Nitrogen and potassium levels were nearly the same in the two samples, but phosphorus was nearly three times higher in the chicken litter compost. Since soil tests indicated high levels of phosphorus in the soil (perhaps from past applications of chicken litter), the growers considered the lower phosphorus analysis of the clover compost to be a benefit. Copper was nearly three times higher and sodium and calcium were nearly twice as high in the chicken litter compost than in the clover compost.

The growers did not produce enough clover compost during the project to eliminate the need for other sources of nitrogen for the season. This was largely due to an extremely hot and dry summer, which limited the growth of the clover. However, the fertilizer values in the compost analysis indicate that the growers would need to produce approximately five tons of compost per acre for their four acre garden if they were to rely on the compost alone to supply the 80 to 120 pounds of nitrogen/acre that the garden requires. They produced approximately six tons of compost for the whole garden.

The growers decided that the clover compost was a better choice for them than the chicken litter compost because: 1) the clover compost had comparable levels of nutrients when compared to the chicken litter compost but had significantly lower levels of phosphorus, sodium and copper which they did not want and 2) there was no real difference in cost between the clover compost and the chicken litter compost.

Outreach

A field day was held June 4, 1995. The whole system of using clover as a living mulch in organic vegetable production was presented along with a demonstration of the composting project. The 42 attendees included farmers, extension personnel, consumers, home gardeners and one state agriculture department representative. The ripple effect of publicity after the field day resulted in a television report and two articles in magazines, plus several new members to the Alabama Organic Fruit and Vegetable Growers Association.

The project investigators presented a slide presentation at the Alabama Fruit and Vegetable Growers Association meeting and at the Southern Sustainable Agriculture Working Group conference. The investigators are also compiling a mailing list of people interested in receiving copies of the results at the completion of the study.

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PG94-14
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December1996

Cut Flowers as a Sustainable Agriculture Alternative

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Recent figures indicate Oklahoma revenue from cut flower sales total more than $9 million per year. Of this, only approximately $300,000 are produced in Oklahoma. National wholesale production of cut flowers and greens is estimated at over $560 million per year. Production of specialty cut flowers (all species except roses, chrysanthemums and carnations) is a rapidly growing section of the cut flower industry.

Many cut flowers are imported into the region from other countries. The Mississippi State publication, *Inventory of Non-traditional Agricultural Commodity Activities in the Southern Region* (1990), lists only three references to floriculture and production; they are located in Kentucky, Mississippi and Washington, D.C. In Oklahoma, the diverse soil and weather conditions and the long growing season could allow production of numerous cut flower species, ushering the small farmer into heretofore untouched markets.

Many small farm operations in Oklahoma are experimenting with sustainable crop alternatives to their conventional crops. Berries, herbs, legumes and organic vegetables have proved to be popular sustainable alternatives to corn, wheat and cattle. Cut flowers typically are not among the crops considered for agricultural alternatives. Production literature, research and essential start-up information about cut flowers is virtually unknown in Oklahoma. In this project, two producers converted wheat acreage to a cut flower production system in order to evaluate the feasibility of cut flowers as an alternative crop in Oklahoma.

Objectives

1.) Develop a prototype of a mixed-species specialty cut flower production system.

2.) Test the use of rye and other winter cover crops as a nitrogen source and as companion plants for specialty cut flowers.

3.) Develop "how-to" materials about the incorporation of cut flowers into sustainable farming systems.

Approach

The prototype, expanded from one-half acre the first year to three acres the second year, accommodates woody plants such as pussy willow, lilac, butterfly bush and forsythia; annual and perennial flowers; bulbs and groundcovers such as ivies and lily of the valley. The species were selected to allow year-round harvesting, with many species harvestable three months of the year.

The area is set up into 50 (36-inch) raised beds, divided by a walkway to accommodate a small tractor with tiller attachment. The beds are watered by a trickle irrigation system that delivers eight to 10 gallons per minute.

A 14-14-14 formula fertilizer was applied when the beds were built, sidedressing after that as needed. In winter 1994, a rye cover crop was planted on the entire three acres. It was turned under and chopped when the beds were rototilled in the spring. Although this produced a good stand, the producers switched to a mixture of annual rye and austrian winter pea in 1995 after consulting with agronomists at OSU. The growers now utilize winter and summer cover crops and legumes as nitrogen sources to meet future fertility needs.

Due to a severe drought from August 1995 until July 1996, summer legumes were not planted. The winter cover crops did well, though. The growers planted white, red, crimson and arrowleaf clover and austrian winter peas. They plan to mow the cover in spring and apply the clippings directly to the beds as mulch. They mulched the beds with oat and wheat straw during the 1996 drought, and they reported that it helped retain soil moisture.

Their program of mulching and ground covers was so successful that they used only one half of the fertilizer used the year before, even though they increased the number of beds from 36 to 50! In fact, they only needed to top dress two new crops: dalias and gladiolas, particularly heavy feeders. They were top dressed with compost made from chicken manure and plant material from last year's production. Composting is very time consuming for these growers but they feel that it is very necessary and have purchased a manure spreader to facilitate their work.

The growers attribute visibly improved soil texture to the cover crops and mulches.

Project area
Alternative crops

Project duration
2 years

Budget:

SARE	$ 6,000
ACE	
Matching	$ 3,100

The high clay content soil, which two years ago was hard when dry, can now be worked with bare hands, no tools needed. Weeds not controlled by the mulch/cover crop system were removed by hand or with the tiller, except for for tough grasses in the rows which were treated with over-the-top applications of a post-emergence herbicide .

The growers believe 1996 saw highter insect problems due to dry weather. Nevertheless, the growers observed large numbers of lady beetles as well as assassin beetles. They treated an early occurrence of spider mites with hot pepper spray and applications of Safers soap. Grasshoppers were treated with No-Lo bait, which the growers expect will show positive results next year after the bait has infected the grasshopper eggs. Outbreaks of bud worms were controlled with twice monthly spray applications of *Bacillus thuringiensis* (Bt). The growers hope that use of clover and other cover crops in open areas will attrract beneficial insect species.

Results

The growers have found the cut flowers to be a successful alternative crop for their operation, but marketing still remains the toughest problem they face. Education has been identified as their most effective marketing strategy. Florists are unfamiliar with the flowers the producers are growing and, therefore, don't know how to order them or make use of them. The growers have been addressing this educational need with regular visits to area florists in order to share the latest information on flower species and post harvest care.

Even though the growers are still making personal visits to potential clients to show them their flowers, they believe that once they have their marketing plan in place that they will see an increase in orders and requests for information. Experience has shown that if buyers see their flowers, they usually will buy. In fact, one of the growers tried for over a year to get a florist to talk to her. When she was finally allowed to show him her products he placed a standing weekly order for as long into the fall as she had flowers.

Any new business takes from three to five years to become profitable, and the growers say theirs is no different. They have kept detailed production and profit records on each crop to fine-tune the growing and marketing system. They have done very well in the three years they have been in the cut flower business and are currently working on plans to ensure their continued success. This includes collaborating with a business specialist at a nearby vocational/technical school to formalize a business plan, a marketing plan and a budget.

In 1996, their third year, the growers hired a full time employee and their sales have gone from $3000 the first year to $24,000 the past year. Since they are selling to two percent of the market the growers feel that they have plenty of market in which to expand their business.

Outreach

The producers, working in conjunction with OSU horticulturists, have produced a fact sheet about cut flower uses and post harvest care. This has been distributed to florists and to ATTRA. They made presentations at the OSU Cut Flower conference, Texas Speciality Cut Flower Conference, the Horticulture Industries Show in Tulsa and numerous garden clubs. A field day at their farm was held in September 1995, and 40 people attended. In 1996, in addition to numerous talks and lectures, the growers hosted groups at their farm. They also spoke at the OSU Spring Cut Flower Conference, with 177 people in attendance. They also hosted a tour of their farm.

The producers cooperated with Benary Seed Company on postharvest trials of zinnias, lobelia, scabiosa and gaillardia. The vice president of Benary attended their field day and later presented the results of their trials at the Speciality Cut Flower Conference in Baltimore. An article in *Oklahoma Farmer-Stockman* featured their operation in a cover story complete with color photos.

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No-Till Vegetable Demonstration

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Due to increased regulations and loss of farmland, fewer acres in the South are available for vegetable production. Of the available acreage, some is not suitable for production because the slope is too great for conventional production practices.

This producer has developed a no-till system for vegetable production that, compared to conventional tillage methods, uses fewer chemicals, reduces erosion, utilizes cover crops for moisture management, and allows planting and harvest in times when conventional methods don't allow access to the field.

Objectives

1.) Demonstrate no-till compared to conventional-till production systems for cabbage, tomato and pepper in three regions of Virginia.

2.) Develop a videotape and manual on no-till vegetable production.

Approach

Farmers and agricultural service providers met in August to establish an agenda for conducting demonstrations of the producer's no-till system for vegetable production. Conventional-till production systems were selected and used as comparisons to the no-till system.

The producer developed, with university personnel, a one-pass no-tillage planter that has two components: 1.) a subsurface tiller and 2.) transplanter following behind. The planter works in heavy residues, has high survival rates and has good weed suppression.

The no-tillage system results in little or no erosion. This has been found to be true on slopes up to 20 percent. The producer's no-tillage system was utilized in a project by Virginia Polytechnic University researchers in a rainfall simulation field trial. They found little to no erosion on the plots prepared with his system.

Outreach

In 1995, the producer held a field day attended by approximately 40 growers. In June 1996, near Williamsburg, Virginia, 20 growers attended his demonstration of the system in the production of tomatoes, pumpkins and cantaloupes. In September 1996, for a group of growers in Suffolk, Virginia, he demonstrated establishing pumpkins with his system.

In December 1996, the producer spoke at the North Carolina Vegetable Expo. His talk was titled *Implementing Sustainable Systems for Profitability: no-tillage production of vegetables.*

A videotape and manual entitled *Guidelines for No-till Production of Transplanted Vegetables* are being developed as part of the project. An abbreviated version of it was shown at the North Carolina Vegetable Expo. The producer will make copies of the videotape and manual available to interested farmers, grower organizations and agricultural service providers throughout Virginia.

Project area

No tillage

Project duration

2 years

Budget:	
SARE	$8,300
ACE	
Matching	$17,200

SARE
Sustainable Agriculture Research and Education
Southern Region

PG95-21
Annual Report
December1996

Pecan IPM Using Black-Eyed Peas as a Trap Crop

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Stinkbugs occur throughout the South and cause kernel damage to pecans in all pecan growing states. In Texas, most stinkbug damage occurs August through November when stinkbugs move from nearby crops and weeds. Stinkbugs cause a direct loss of three to five percent of the economic returns from southern region pecans, although losses within individual orchards can reach 40 to 50 percent.

Using their needle-like mouthparts, stinkbugs pierce the pecan shells and feed on the maturing kernels. The resulting damage is a dark, sunken, bitter-tasting spot on the pecan kernel (kernel spot). Farmers are not paid for stinkbug damaged kernels.

Preliminary information suggests that small plantings of black-eyed peas in pecan orchards can help pecan growers manage stinkbugs. The bugs are attracted to the black-eyed peas on which they may feed preferentially, potentially reducing pecan kernel damage.

The grower's goal was to utilize the trap crops in one or more of four ways. They first used the trap crops to monitor populations of stink bugs (it is much easier to sample black-eyed peas than pecans). Second, they used the trap crops to attract and hold the stink bugs, thereby preventing nut damage. Third, if large numbers of stink bugs were found, the growers could spray the trap crop. By not spraying the trees, the growers would avoid creating the secondary pest outbreaks of aphids which commonly occur when broad spectrum insecticides are used on pecans in West Texas. Lastly, if stink bug populations in the orchard reached levels at which high levels of kernel damage were imminent, they could spray the trees, using the population levels in the trap crop as a decision making tool.

Objectives

Determine if black-eyed peas serve as a trap crop for stink bugs, reducing damage in pecan orchards.

Approach

The growers used two orchards in this study. In the first, southern pea trap crops were established on about 1.5 percent of a 650 acre irrigated orchard in 1994 and 1995. The second orchard, 20 miles north of the first, was not planted with trap crops and was used as a control.

Each year, scouts sampled the pea trap crops on a regular basis with a standard (15-inch hoop) sweep net to determine stink bug species, infestation levels and population changes. They used this information to make management decisions on insecticide application.

At harvest, 100 samples of 20-22 nuts were taken at various distances from the trap crops to assess the activity and success of using trap crops to protect pecans from stink bug damage. Farm-wide levels of stink bug damage were estimated by pooling these data.

In 1994, eight cowpea trap crops of two rows with two beds/row (about five acres total) were established at 800 to 1,200 foot intervals. They were planted between the tree rows, ran the same length as the tree rows and were planted on July 19 and August 1. Sweep net samples were taken on September 12, 20, 23, 27 and October 7, averaging 2500 sweeps/sampling date (range 1,600 to 3,300). The growers applied no pesticides to either the pecans or the trap crops as a result of the sweep data.

The growers sampled pecans on October 21 and October 27 by taking approximately 100 nuts at 22 locations (total of 2409 nuts). They took four replications of 100+ nut samples at 0-10 feet, 90-110 feet and 290-310 feet from the cowpeas to assess how distance from the trap crop affected stink bug damage. Another set of samples were taken from 0-10 feet to 2000 feet from the cowpeas. They examined the sample nuts for evidence of stink bug damage.

In 1995, nine pink-eye purple-hull pea trap crops of 4 rows with one bed/row (about 10 acres total) were established at 800 to 1,200 foot intervals in the first orchard. The plantings were again established for the length of the tree rows in between the rows. The trap crops were planted on August 1 and 10. Sweep samples were taken on August 28, September 5, 11, 19, October 2, 9, 16 and 27. An average of 2255 sweeps were taken per sampling date (range 1,900 to 2,900). Using the sweep data as the basis

Project area

Pest management

Project duration

2 years

Budget:

SARE	$4,000
ACE	
Matching	$4,098

for treatment decisions, no insecticides were applied to the trap crops or the trees.

The growers took nut samples from the trees planted with trap crops on October 31, November 10 and 18. Twenty samples of approximately 100 nuts (total of 2, 065) were taken. The growers took six samples at 90 to 128 feet, six samples at 290 to 317 feet, and two samples at 619 to 620 feet from the trap crops. As they did in 1994, they examined the nuts for stink bug damage.

No differences in stink bug damage to pecan kernels were observed 0, 100 and 300 feet from the trap crop plantings in either 1994 or 1995. The growers did note a trend toward increased damage at 600 feet from the tree rows.

The growers noted strong reductions in stink bug damage when comparing the orchard with trap crops to the orchard without trap crops. In 1994, the trap cropped pecans sustained only 70 percent of the damage sustained by the non trap cropped pecans. In 1995, a year with low stink bug problems in the region, the trap cropped pecans sustained 91 percent of the damage of the non-trap-cropped pecans.

The cowpeas used in the 1994 study performed well. They maintained good growth, leaf color, flowering, and pod set for 45 days. The pink-eye purple-hull peas used in the 1995 study were chlorotic (yellow) in spite of an expensive iron treatment. They demonstrated poor growth, blooming and pod set and were a poor choice for a trap crop planting in west Texas.

Results

When the growers compared the average dollar losses from stink bugs between the trap cropped sites and the non- trap-cropped sites they found that the non-trap-cropped sites sustained $29.29 more stink bug associated losses than did the trap-cropped orchards. It cost the growers approximately $2,112.50 (about $211.25/acre of peas) to establish and maintain the trap cropped peas. When spread over the 650 acres of the pecan farm being affected by the presence of the trap crops, the growers spent $3.25/acre (of pecans) to establish and maintain the trap crops. The growers determined for every dollar they spent establishing and maintaining the trap crops, they prevented $9.01 in kernel damage from stink bugs.

Outreach

Results will be published in the agricultural popular press (e.g., *Pecan South Magazine and Southwest Farm Press*) and newsletters. Project results will also be presented at the Texas Pecan Growers Association meeting, the Permian Basin Pecan Conference, and to the Southwestern Irrigated Pecan Growers.

SARE
Sustainable Agriculture Research and Education
Southern Region

PG95-22
Annual Report
December1996

No-Till Grain Production for Soil and Moisture Conservation

Project Coordinator

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Cooperators

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Oklahoma State University

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Monsanto Chemicals

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Jack Lyons
DuPont Chemicals

John Cagle
Miles Laboratory

Junior Allard
Panhandle Implement

David Austin
PBI/Gordon

Collingwood Grain

Producers:
Glen Plunk
Delmar Plunk
David Harrison

In the early 1980s, the producer was using a rotation of wheat-fallow-wheat-grain sorghum in a conventional dryland tillage system. Because of declining farm profits he realized that farming sustainably was possible only if he made some significant changes to his operation.

At that time, little local research was available on utilizing and conserving water with no-till systems, so the producer experimented with his own system to boost yield and profitability through improved water utilization and conservation. By 1984, he had a workable system that could be used by other farmers. During the past 10 years, he has continued to fine-tune the system and help fellow producers adopt parts of it for their operations.

Objectives

1.) Demonstrate the effectiveness of dryland no-till management systems for water conservation.

2.) Instruct other farmers in the adoption of dryland no-till management systems to improve water conservation.

Approach

This project is an ongoing field demonstration to show farmers that they can increase net profit with a no-till system that encourages water conservation. Past demonstrations have successfully shown other producers how to conserve water. With the increased importance of conservation compliance, no-till management will continue to be an important practice on both dryland and irrigated land.

Outreach

The producer conducts tours and workshops on his farm. He has done this annually since 1984, with about 300 people now attending. In 1995, he presented a no-till workshop and tour that featured information on residue management and moisture conservation. Included in the demonstrations were short seminars by extension personnel and university specialists, as well as presentations by other producers who have adopted this system. Due to a severe drought and the loss of the local research and extension specialist, the annual workshop and tour was cancelled in 1996. However, the producer is currently preparing for the 1997 no-till workshop and tour.

Project area

No till

Project duration

2 years

Budget:

SARE	$9,818
ACE	
Matching	$19,636

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PG95-23
Annual Report
December1996

No-Till Cotton Production Using Best Management Practices

Project Coordinator

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Cooperators

Ernest Flint
Cooperative Extension
Mississippi

In the Central Hill region of Mississippi, cotton yields range from low levels of 350-500 pounds to higher levels of 700-1000 pounds per acre. Cotton yield in this area is closely tied to tillage and fertilization practices. However, these practices vary widely among producers.

Conventional deep tillage has not been shown to be consistently beneficial to cotton growth and has been implicated in increased rates of erosion. In terms of fertilizer application, it is imperative that timing, amount and method of application suit local conditions in order to acheive adequate yields while maintaining environmental quality. Over the past few years, research has shown that adequate yields can be achieved without increasing input costs, through the implementation of no-till practices and the judicious use of fertilizers. The most successful farmers who have adopted these practices have achieved yields of 1000 pounds per acre or more by using no-till management and the proper balance of fertilizer nutrients.

Objectives

1.) Compare no-tillage and conventional-tillage treatments, with and without covers of winter wheat, on cotton.

2.) Demonstrate project results to area farmers in an annual field day.

Approach

The main problem being addressed in this project is finding a practical and successful approach to the selection of tillage and nutrient management systems for soils common to the Central Hill region of Mississippi. This project is expected to require three years because of the transition of the fields from their currently disturbed condition to a realistic no-till condition. The producer is in the process of testing local findings that show conventional deep tillage is not consistently beneficial to cotton growth and development.

The three experimental treatments used in this project include conventional tillage, no tillage with a winter wheat cover and no tillage with a cover of volunteer vegetation. The volunteer vegetation was comprised primarily of three species: henbit *(Lamium amplexicaule),* mouse ear chickweed *(Cerastium vulgatum)* and annual bluegrass *(Poa annua).* Lime was applied to the entire area to bring soil pH to 6-6.5. Phosphorus, potassium and sulfur are applied to all treatments according to soil tests and nitrogen is applied according to soil tests, with side dressings as indicated.

The grower harvested the treatments with a two-row John Deere spindle picker taking two rows out of each treatment area. The yield was dumped from the picker into a trailer sitting on wheel weighers. The harvested strips measured 0.765 acre. The results from the first year of the trial are as follow.

SEED COTTON YIELDS lbs/ac

Treatment	1st Pick	2nd Pick	Total	Est. Lint*
No-tillage/ wheat cover	1732	457	2189	788
No-tillage/ Volunteer veg.	1863	522	2385	859
Conventional tillage	1928	457	2385	859

* The estimated lint yield per acre is based on a 36 percent lint turnout after ginning.

It is not unusual for the first year yields of no-till to be lower than those of conventional till. The fact that the no-till treatment with a winter cover of native vegetation produced the same yields as the conventional-till treatment leads the grower to believe it will do even better than conventional till next year.

Both no-till plots matured later than the conventionally tilled plot. The second picking from the no-till treatment with a wheat cover crop did not make up for the lower first picking, and the yield from this treatment was a little more than eight percent lower than the conventional tilled plot. However, the no-till plot with a cover of native vegetation exhibited the highest yield at second picking and exhibited a total yield equal to that of the conventionally tilled plot.

Outreach

The proposed test area is adjacent to a heavily traveled local road, and farmers from

Project area

No till

Project duration

3 years

Budget:

SARE	$8,295
ACE	
Matching	$53,280

the community are able to watch the project's progress. Growers then discuss the project with the project cooperators to find out how the project is doing. Field days will be held during the second and third years of the project. Results of the test will also be published in local extension bulletins.

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PG95-24
Annual Report
December1996

Alternative Control of Soil Diseases in Vegetable Production

Project Coordinator

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Cooperators

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Blacksburg, VA

Joseph Hunning
Extension Agent
Christiansburg, VA

Development of non-chemical controls for soilborne pathogens are needed in the search for sustainable agricultural practices. Methods for growing a number of fresh market vegetables typically includes the practice of soil fumigation. This practice is required to control a number of soilborne plant diseases.

Recent research suggests that the application of organic wastes may reduce the incidence of several fungal and microbial diseases on vegetable crops. The application of dried or composted organic wastes (cabbage, grass clippings, food waste, etc.) has been suggested as an alternative method for currently used fumigation technology. For example, cabbage leaves have been implicated in the release of toxic chemicals upon decomposition. These compounds are believed to be released for a short time in minute amounts but may be highly effective in reducing soil-borne disease pathogens. If a practical application could be developed to utilize these compounds, producers would have a sustainable on-farm method of disease control.

Another promising control measure which does not require chemical fumigation is solarization. Typically, soil is solarized by placing a transparent plastic cover over the crop area during periods of greatest solar radiation. The trapped heat can potentially reach temperatures high enough to kill soil-borne disease agents.

Objectives

1.) Determine the efficacy of dried cabbage residue and grass clippings as a mulch for the control of soilborne pathogens.

2.) Determine the efficacy of soil solarization for the control of soil-borne pathogens.

Approach

Field plots (4 ft. x 150 ft.) will be prepared and dried cabbage residue and grass clippings will be spread over them. Other field plots of the same dimensions will be covered with clear plastic film. Strawberries followed by watermelons will be planted in the plots which will be monitored for pest and insect damage.

Outreach

Two field days will be held during the course of this study. The first will be in late summer and will focus on the use of solarization and organic amendments to prepare areas for annual strawberry production. The second field day will be held at the time of strawberry harvest. The focus of the second field day will be to discuss the success or failure of solarization and organic amendments in strawberry production.

Project area
Vegetable production

Project duration
2 years

Budget:

SARE	$5,625
ACE	
Matching	$4,060

SARE
Sustainable Agriculture Research and Education
Southern Region

PG95-25
Annual Report
December1996

Development of Potting Soil Mixes from Local Wastes

Project Coordinator

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Cooperators

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South Dade Soil andWater
Conservation District

Herbert Bryan
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Florida Nurserymen and
Growers Association

Charles Yurgalevitch
Mobil Irrigation Lab

Almond Tree/South Dade Nurseries in Dade County, Florida, requires a financially and environmentally sound substitute for the potting soil mix currently in use: a mixture of peat, pine bark and sand. Peat is expensive and depletes a natural resource that could be saved if a good quality substitute can be found.

Objectives

1.) Develop a potting soil mix from composted organic materials, including sewage sludge and organic waste products that have been source-separated from the rest of the refuse stream and are currently going to landfills and incinerators.

2.) Evaluate the potting soils for fertility, moisture rentention and performance in a greenhouse setting.

Approach

The producers are growing four varieties of nursery stock (green buttonwood, silver buttonwood, gumbo limbo and Christmas palm) in containers filled with the professional potting mix and also in containers filled with composted yard waste. The composted yard waste comes from a nearby municipality, which screens it for non-yard waste materials prior to delivery.

All of the plants in both sets of containers are fertilized identically with 16-4-8 fertilizer and also receive the same amounts of water. A pre-emergence herbicide is applied equally to both sets.

Results

After one year, the plants grown in the composted yard waste have performed as well as those grown in the professional potting mix. Furthermore, the professional potting mix costs $21.28/cubic yard while the composted yard waste costs $15.00/cubic yard. These results are still preliminary, but the producer intends to use more composted yard waste as a potting medium in his nursery even before the project is completed.

Outreach

Field days, seminars and mailings will be used to disseminate information on the new potting mix. Once the producers have finished their project, they will educate the nursery community on the value of source-separated, clean, organic waste compost as a potting medium.

Project area

Composting

Project duration

3 years

Budget:

SARE	$9,600
ACE	
Matching	$13,800

SARE
Sustainable Agriculture Research and Education
Southern Region

PG95-26
Final Report
December1996

Testing the Efficacy of Alternative Methods of Whitefly Control in Organic Vegetable Production

Project Coordinator
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Whiteflies, including the sweet potato whitefly, the silverleaf whitefly and the greenhouse whitefly attack a broad range of economically important vegetable and field crops, and have recently increased in importance in the western and southern United States. Whiteflies damage crops by feeding on plant sap. More importantly, whiteflies are capable of transmitting viruses to a wide range of crops.

Biogeographic surveys of whitefly populations from 1989 to the present indicate that whiteflies inhabit nearly every major agricultural locale in the southwestern and southeastern states and Hawaii. Economic crop losses due to whiteflies and their associated viruses have been especially significant in Florida, Georgia and South Carolina. An important factor responsible for the whitefly's prevalence in agricultural areas is its ability to feed, multiply and survive on an extremely wide range of host plants.

On their certified organic farm in Florida, the producers observed large whitefly populations during the entire cropping season. They experienced nearly 100 percent virus infection of snap beans and tomatillo. Overall, the viruses transmitted by whiteflies are their largest production problem.

Pesticide application is the most common method of whitefly control on conventional farms. However, organic farmers interested in alternative approaches have limited methods available for whitefly control. In this research project, the producers will conduct an on-farm experiment to determine if an economically feasible control program utilizing an integrated pest management approach can be developed for small to medium-size farms.

Objectives

1.) Determine if the use of reflective mulches under beans is an effective means of whitefly control.

2.) Determine if intercropping beans with squash is an effective means of whitefly control on beans.

3.) Determine if intercropping beans with *Nicotiana fragrans* is an effective whitefly control.

4.) Develop a botanical insecticide produced from extract of *Nicotiana gossei,* and test it on squash as a control for whiteflies.

Approach

The plot size is 10 feet long with four treatments/plot. Each plot is replicated four times giving a total of 16 treatment-replications. The producers are comparing both the number of whiteflies and the percentage of virus infection on beans planted under the following treatments:

1.) beans planted on bare soil,

2.) beans planted on plastic mulch,

3.) beans intercropped with squash and planted on bare soil,

4.) beans intercropped with squash and planted on plastic mulch.

The squash is used as a trap crop planted with the beans because squash is very attractive to whiteflies. The beans are inspected for symptoms of viral infection on a weekly basis. Whiteflies are sampled once a week in the early morning when they are less active. At maturity, all of the bean plants are harvested and weighed for each treatment.

Results

The fall 1995 test provided inconclusive results due to a number of reasons including an early freeze. The results of the fall 1996 and spring 1997 tests will be reported in the 1997 Southern Region SARE Annual Report.

Originally the growers had planned to plant *Nicotiana fragrans* with the beans to test if the *N. fragrans* would repel whiteflies from the beans. This plan was discontinued when the producers discovered that germination of the *N. fragrans* seeds they had was very poor, and there were no other dependable sources in the United States.

The producers did achieve adequate germination of *Nicotiana gossei* and attempted to prepare an aqueous solution of extract for application to squash plants to determine if it reduces whitefly incidence and the virus it carries. They discovered that the plants did not produce enough biomass to make sufficient quantities of extract. The growers are working on that problem with trials in their greenhouse.

Cooperators

Hugh Smith
Entomologist

Heather McAuslane
Entomology/Nematology
University of Florida

Project area

Biological control

Project duration

1 year

Budget:

SARE	$5,200
ACE	
Matching	$1,875

Outreach

Project results will be submitted to agriculture and plant pathology journals and papers presented at the Florida Plant Pathology Society or the Florida Entomological Society. The producers will hold a field day for local growers, extension workers and master gardeners.

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Sustainable Agriculture Research and Education
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PG95-27
Annual Report
December1996

High-Value, Small-Scale Sustainable Vegetable and Fruit Production Methods

Project Coordinator

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Cooperators

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Farm Management/
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Rural Advancement
Foundation

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During the last decade many farmers have gone out of business, in part due to the rising costs of land, machinery, chemicals, fertilizer and seed. Young people are finding it increasingly difficult to make the capital investments necessary to enter farming. The producers will demonstrate that a sustainable profit may be made from as little as two acres and a few purchased organic fertilizers, using no chemicals, tractors or tillers.

Objectives

1.) Demonstrate how to improve soil physical properties and fertility through the use of mulches and animal manure.

2.) Demonstrate that lowering farming inputs through the use of mulches and animal manure can increase economic sustainability.

Approach

The producers created an additional one-acre garden on their farm specifically for this project. They are planting a series of vegetable and fruit crops over three years. The crops are corn, sweet potatoes, cabbage, strawberries, watermelon, cantaloupe and butternut squash. The garden will be divided into four equal sections and fruit and vegetable crops will be rotated on the sections during the project.

Results

During the first year of the project the growers experienced severe weed problems. The area chosen for the one-acre project garden had not been farmed for a number of years, and the mulches could not control the weeds. The weeds, primarily johnson grass, dock, and poke finally had to be cut by machine, a task the producers had hoped to avoid.

In 1997, they plan to mulch two sections of the garden with hay and two sections with black plastic. The treatments will be reversed the following year. Soil fertility will be maintained with manure and the decaying hay. They will document soil inputs, changes in soil texture and fertility, results of treatments per crop, gross income and net income.

Outreach

One field day is planned after the first results are available, about half way through the project. Another one is scheduled near the project's completion date. The producers will work with the North Carolina Cooperative Extension Service and present their results at a public workshop at the extension office. The workshop will cover intensive gardening and organic methods. They will also present their results at the North Carolina Vegetable Growers Expo and at the Carolina Farm Stewardship Association Sustainable Agriculture Conference at the end of the third year. Results will be reported in the Carolina Farm Stewardship Association newsletter.

Project area
Vegetable production

Project duration
3 years

Budget:

SARE	$9,612
ACE Matching	$4,942

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Southern Region

PG95-28
Annual Report
December1996

Improving Tropical Soils by Using Organic Wastes

Project Coordinator

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Lake Carite in Puerto Rico is surrounded by forest and farmland. The farmers utilizing the land surrounding the lake grow citrus, coffee and bananas and some annual crops. Some of the fertilizers and pesticides used by the farmers are leached into the lake.

In many tropical ecosystems nutrients are held in the standing biomass and not in the soil. When the natural vegetation and nutrients are removed from the site, the fertility of the bare soil is low. In the absence of protection, the topsoil erodes, and the remaining soil does not respond well to fertilization. Consequently, the citrus crops are not responding to traditional fertilizer recommendations and fertilizer use is increasing.

The local fruit processing plant and poultry farm near the lake have waste disposal problems. The project seeks a practical solution to the plants' waste disposal delimma and to the farmers' soil fertility problems.

Objectives

1.) Construct compost piles primarily of fruit waste and poultry manure with seaweed, sand, calcium carbonate and leaves.

2.) Demonstrate to area farmers how to build compost piles.

3.) Demonstrate to area farmers how to use compost to increase organic matter in their soil.

Approach

The compost piles are housed on a demonstration farm in wire-mesh sided structures with concrete floors and tin roofs. The piles are turned regularly. Temperature, humidity and pH are monitored in all the compost piles on the demonstration farm to ensure adequate composting. These compost piles will be used as controls against which the performance of the compost piles of the participating farmers' fields will be compared. In this way, a participating farmer's compost pile can be adjusted and improved to obtain a better compost. There are now 10 farmers participating in the project, six from the area and four from surrounding counties.

Results

In addition to obtaining fruit waste and poultry manure from local sources, the project coordinators also purchase cow manure because they have learned it is helpful to keep a large stock on hand for the project. They have also found that the addition of seaweed increased the nutrient content of the compost.

The compost piles constructed in the bins on the demonstration farm take nine weeks to mature. On some of the participating farms the compost piles produce fully useable compost after 12 weeks. The differences are likely due to composition and size of the piles and air temperature due to elevation. In all cases the piles are turned every 20 days.

Mature compost has been applied to citrus trees, used as a potting medium for nursery trees and as a soil amendment in vegetable gardens. The cooperators report that when compost was applied to citrus trees, chlorosis was corrected, and the general appearance of the trees improved.

Outreach

Farmers are invited to attend workshops about composting through notices posted in local extension and NRCS offices. During the past year the cooperators have held 16 workshops for area farmers. The average attendance has been 12 with up to 30 people attending some workshops.

Farmers who cultivate fragile land on the lake shore have been visited by project participants who tell them of the project and how they can benefit from it. The cooperators demonstrated composting to 200 people at an Earth Day gathering. They have received invitations from groups in other counties requesting demonstrations on compost pile construction. With the help of cooperating government agencies, printed material will be produced covering composting and organic farming methods.

Cooperators

Megali De Orbeta
Ana Isabel Rivera
Harold Rivera
Miguel Delgado
Franklin Roman
Gerald Rodriguez
Gregorio Bario Guavate
Felipe Piazza
Dalma Cartagena
Felipe Rivera Carr
All producers

Ramona Maldonado
USDA-RCS

Oscar Muniz
Cooperative Ext. Agent

Enrique Santiago
Dept. of Natural Resources

Amigos Agricultura Ecologica Santurce

Fundacion Ambientalista Osho

Tropical Sources

Ama a tu Gente Salva el Ambiente

Project area

Composting

Project duration

3 years

Budget:

SARE	$10,000
ACE	
Matching	$20,400

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PG95-30
Annual Report
December1996

Management of Artificial and Restored Wetlands to Improve Water Quality

Project Coordinator

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Cooperators

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Labelle, FL

Wet detention basins are used to hold water and gradually release it, slowing runoff from agricultural areas into ecologically sensitive areas, including bodies of water. The slower runoff is often lower in agriculturally loaded nutrients than if it had run directly into the sensitive area.

Many citrus growers and other producers lack specific knowledge of the water quality improvements and ecosystem benefits that wet detention basins provide to agricultural operations. Growers also are skeptical that sustainable methods can be implemented in a manner that is both cost-effective and enhances product quality. While growers understand how field practices affect their product output and cash income, many have far less understanding of how they can affect the environment through sound management of wet detention basins on or near their operations.

Objectives

1.) Reduce nutrient loads entering a water body through the restoration of an ecologically diverse wetland serving as a wet detention basin.

2.) Restore wetland functions and reduce direct pumping of drainage water into the wetland.

3.) Educate growers on the use of a wet detention basin.

Approach

The project will restore a 10.3-acre agricultural retention area and will include one shallow freshwater marsh, a hardwood swamp, a hardwood hammock, a native palm hammock, two deep ponds, and a transitional hydric flatwoods area.

Excavation and land grading will route pumped water from the grove through the different wetland types and into a major drainage canal. Vegetated broad-crested weirs will be used where possible for controlling water movement within the retention area.

Monitoring of water quality will be performed periodically for three years after wet detention basin installation. Monitoring of vegetation changes will be recorded with still photography and video by the Water Management District and the landowner for future reference and for educational activities.

Outreach

Field days are scheduled for months 16 and 36 of the project and at 48 months, one year after project completion. The field days will be directed toward landowners, conservation groups, consultants, local state and federal agencies, citrus growers and the general public. In addition, public outreach will include press releases, journal articles and extension publications.

Project area

Wetland management

Project duration

3 years

Budget:

SARE	$10,000
ACE	
Matching	$140,200

SARE
Sustainable Agriculture Research and Education
Southern Region

PG95-31
Annual Report
December1996

Improving Quality of Slaughter Hogs as a Marketing Strategy for Small Producers

Project Coordinator

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Cooperators

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Elizabethtown, KY

Richard Coffey
Swine Specialist
Glenn Mackie
County Agent
Gary Carter
County Agent
All Cooperative Extension

The Bluegrass Pork Producers Association in East Central Kentucky is devoted to improving swine production through education and marketing. Because of a change in the marketing structure of slaughter hogs and the closure of two Kentucky packers, smaller producers have been forced to contract with low-volume auction markets. The lower volume markets pay them less than direct-market truckload lots to larger packers. By improving carcass quality, the producers involved with the project hope to receive higher prices from the lower volume auction markets.

Objectives

1.) Demonstrate the utility of ultrasound technology to improve carcass quality in slaughter hogs.

2.) Improve quality of slaughter hogs in the Bluegrass Pork Producers Group.

3.) Improve breeding consistency of swine in the Bluegrass Pork Producers Group.

Approach

Data were collected on fatback content and depth, loin depth and percent lean of each animal by extension personnel using ultrasound technology. The information was used to analyze the characteristics of participating producers' hogs to improve breeding and marketing. The ultrasound technology was applied to the selection of breeding gilts in the project. In the first six months of 1996, 476 gilts were weighed. Fat and loin depth also were measured at that time.

Ultrasound technology is most accurate in predicting desired characteristics of offspring when it is used on young animals approximately 160 days old and weighing from 230 to 270 pounds. Because of this, only gilts were used for this project. The boars used by all of the producer members of the Bluegrass Pork Producers Association who participated in the ultrasound breeding were purchased. The purchased boars were selected on the criteria developed and identified through the use of ultrasound technology. Consequently, all offspring are the result of selection for desired characteristics in both parents.

The ultrasound technician measured the desired characteristics of fatback content and depth, loin depth and percent lean over the tenth rib of each animal. The same technician operates the ultrasound machine for the program throughout Kentucky. This ensures no differences in readings due to different operators. Information from each animal is entered into a computer and used to develop an index which includes the age and weight of each animal.

Outreach

A field day was held in conjunction with the annual Bluegrass Hog Show in Paris, Kentucky, in January 1996. The ultrasound evaluation and computer program were demonstrated on the 143 hogs in the show. Thirty three area producers and more than 100 4-H and FFA youth took part in the demonstration and judging contest. Another field day will be held at the completion of the project.

Project area

Swine production

Project duration

3 years

Budget:

SARE	$9,150
ACE	
Matching	$17,300

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Native Pecan Orchard Management Using Best Management Practices

Project Coordinator

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Native pecan trees predominate in the Red River Bottoms of Arkansas and are typically unmanaged. Since native pecans do not require extensive use of pesticides, as improved varieties do, production of these groves can potentially increase with only minor changes such as the application of fertilizers and the removal of plant debris under them. Production and harvest of native pecans in the area could potentially provide significant supplemental income for producers.

Objectives

1.) Identify native pecan trees capable of bearing marketable nuts.

2.) Demonstrate management practices in native pecan orchards to increase production.

Approach

The producer has, to date, identified and marked 600 individual native pecan trees capable of bearing nuts of marketable value. After identifying the trees to be kept, he removed the trees identified as non-productive. Next he concentrated on orchard sanitation, removing all twigs, tree litter and damaged nuts. He also kept the grass cover clipped. He practices this degree of orchard sanitation in order to reduce the potential of insect buildup.

Tissue and soil samples for analysis were collected around the trees at designated sites. Fertilizer was applied to designated trees based on the soil and tissue results. The silt loam soils required little fertilization. Nevertheless, the foliar tests did point up some nutrient deficiencies. Consequently, the grower applied zinc in the form of $ZnSO_4$ to the soil around the trees at the rate of 100 lbs/acre. He also applied 13-13-13 (NPK) at the rate of 350 lbs/acre.

The producer also tried a different method of fertilizing some of the trees, using broiler litter at the rate of one - two tons/acre. He timed this for the early spring so that nutrients in the litter were available during the summer months. The grower has found that the application of broiler litter has increased the production of many older trees.

Results

Yields in 1996 were 40 lbs nuts/tree from the younger trees and 85 lbs nuts/tree on the older mature native trees. The grower markets the nuts through a local broker in Texarkana, Arkansas. The nuts are cleaned, graded and bagged for sale to several candy companies and confectionaries.

The grower receives an average of 65 to 75 cents/lb, but he has sold pecans for as little as 30 cents/lb to as much as $1.27/lb wholesale. He expects to make money on this project because his out-of-pocket production costs are about 35 cents/lb.

Outreach

The farm was featured in the March 1995 issue of *Progressive Farmer* magazine. Designated areas of identified trees are used as demonstration sites. The cooperators have conducted tours for local producers interested in this type of production system. They have provided information to approximately 23 area growers. Project results will be published in the *Delta Farm Press, Arkansas Farmer* and the *Lafayette County Democrat.* A field day will be held to teach local producers how to increase native pecan production on their farms.

Project area

Pecan management

Project duration

2 years

Budget:	
SARE	$5,986
ACE	$13,700
Matching	

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Cover Crops in Integrated Vegetable Production Systems

Project Coordinator

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Lexington County
South Carolina

Lexington County, South Carolina is a major vegetable producing area. Around 4,000 acres of collard greens, green onions, squash, tomatoes and beans are produced annually. Cover crops are needed to reduce soil losses and improve soil conditions. The current vegetable cropping systems used on much of the land in the county contribute to the loss of seven to eight tons of soil per acre annually. The soils are deep and sandy, requiring high irrigation rates. Because of this, high rates of nitrogen are applied and lost.

Winter cover crops could be used to reduce erosion. Cover crops would also reduce nitrogen losses (by using a nitrogen-fixing species less nitrogen fertilizer would have to be applied), improve organic matter levels, soil texture, soil structure and water-holding capacity.

Cover crops can potentially control certain diseases through their place in a rotation, but some studies have indicated that the incidence of root-knot nematodes and diseases caused by *Pythium* and *Rhizoctonia* can increase following certain cover crops.

Objectives

1.) Test treatments of the cover crops: rye, oats, rye + crimson clover, rye + cahaba vetch, crimson clover, cahaba vetch, hairy vetch, Austrian winter pea, arrowleaf clover and a fallow to control erosion and improve soil fertility.

2.) Determine if any of these cover crops encourage the growth of plant diseases caused by *Rhizoctonia* and *Pythium.*

Approach

The cover crop treatments will be planted in a randomized complete block design replicated four times. Soil will be tested for pH, nitrogen, physical properties, nematodes and *Rhizoctonia* and *Pythium*. Crop dry weight, N content and disease incidence will be observed and recorded.

Results

Preliminary results show that cover crops can potentially control certain diseases through their placement in a rotation. The incidence of root-knot nematodes have been very low in all the cover crops. Preliminary observations also indicate that *Rhizoctonia solani* counts in all cover crop treatments have decreased. However, *Fusarium* counts have increased slightly over the life of the project, but the analyses to separate the counts of pathogenic from non-pathogenic *Fusarium* species have not yet been performed.

Outreach

A field day will be sponsored by local seed companies at the termination of the project. An extension fact sheet and newsletter will be produced and disseminated.

Project area

Integrated systems

Project duration

3 years

Budget:

SARE	$9,285
ACE	
Matching	$11,315

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Southern Region

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Hydroponic Vegetable Production in Conjunction with a Trout Farming Operation

Project Coordinator

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Marjorie Bender
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Sarah Slover
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Debra Sloan
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NC Divsion of Aquaculature and Natural Resources

Producers:
William Cable
Pat Battle

Project area

Aquaculture

Project duration

3 years

Budget:

SARE	$9,975
ACE	
Matching	$6,425

North Carolina is second only to Idaho in the production of commercially raised trout. Trout farms must comply with effluent discharge regulations administered by the Division of Environmental Management within the Department of Environment, Health and Natural Resources. While most trout farms are able to comply with current regulations, the potential for more stringent regulation exists. This producer is situated on a tributary of the South Toe River which has a Clean River designation.

Effluent from trout farms is rich in nutrients. These nutrients can be a source of pollution if allowed to enter a waterway, or they can be a source of nutrients for effluent irrigated plants.

Objectives

1.) Use the drainage effluent from trout ponds to fertigate vegetables and greens.

2.) Adapt tobacco-grower static float-bed and tray system for greenhouse vegetable growing.

3.) Adapt flow-through greenhouse hydroponic system to use drainage effluent from trout ponds.

Approach

The producer is preparing a greenhouse site, constructing two small greenhouses (one for a static system and one for a flow-through system) and installing hydroponic and float-bed systems. Once the greenhouses and the float-bed systems are operational, the nutrients, air and water temperatures from the pond and the raceway systems will be tested and monitored. Thereafter, vegetables and greens will be grown in these systems throughout the three years of the project.

Outreach

The information produced from this project will be communicated through workshops and conferences with trout producers in the area. In the fall of 1995, the producer gave a workshop on this project at the Sustainable Agriculture Conference held in North Carolina. When the project is completed, articles will be produced for Extension newsletters and the bimonthly newsletter of *Rural Voice for Peace.*

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Aquaculture Conversion Model Emphasizing Poultry and Hog Facilities Re-Use and Recycled On-Farm Resources

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As vertical integration increasingly dominates the poultry and hog industries, more farmers undertake huge debt to erect single-use livestock confinement barns in order to contract for poultry or hog production. They often mortgage home and land to meet the integrator's demand for state-of-the-art facilities in order to secure a contract. Then for a number of reasons, often beyond their control, growers find themselves with empty single-use buildings.

This grower seeks to develop a viable alternative use for livestock concentration facilities. Using empty hog barns, he will demonstrate a conversion strategy for indoor production of farm-raised fish. He will use tanks made from common "found materials" and affordable supplies readily available to the farmer.

Objectives

1.) Utilize climate-controlled former livestock barns to house fish tanks made from readily available supplies, and raise fish as an alternative to livestock production.

2.) Use fish manure to fertilize cropland adjacent to fish production tanks.

Approach

One commercial fish tank will be constructed from a disassembled galvanized grain bin and a swimming pool liner. Fish will be produced in a closed recirculating aquaculture system. The system will capture fish manure by filtration and hold it in a sand-bed tank.

A second commercial fish tank also will be constructed from a disassembled galvanized grain bin and a swimming pool liner. The second fish tank will be located in the same building as the first tank. The second tank will utilize a semi-closed system recirculating the water through underground piping to a pond on the farm. The fish tanks will be housed in climate-controlled buildings formerly used for hog production.

Tilapia, and possibly trout (as the weather cools) will be raised in the tanks. The fish manure from the first tank will be applied to adjacent crop land.

Outreach

Farm tours will be given to school groups, farmers and other interested people. A home page for the project will be established and maintained on the World Wide Web. Benny Bunting will present information on the project at conferences of North Carolina SAWG and its member organizations.

Project area

Aquaculture

Project duration

2 years

Budget:

SARE	$6,000
ACE	
Matching	$74,064

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Native Warm Season Grasses As Alternative Hay Source to Annual Sorghum/Sudan Grasses on Family-Operated Goat Dairy

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Dairy Management Systems

One of the primary reasons for the disappearance of the family farm is the difficulty of maintaining a cash flow. Modern agriculture tends to be cash intensive but produces low profit margins. Consequently, farmers often have to accept a reduced standard of living in order to keep their farms. Under such financial constraints, farmers who would like to practice environmentally sound farming often feel they can't afford to try it.

Farmers are always looking for ways to increase income. One alternative is the use of range land to raise meat or dairy goats. Dairy goats provide an array of products including meat, milk, and cheese. The nature of the dairy goat makes participation in all aspects of the dairy possible by family members of all ages. Unfortunately, few small dairy goat operations survive the first five years.

High labor cost is one of the reasons for the poor survival rates. The labor requirements for dairying in general, and for dairy goats in particular, are high. Approximately 12 goats must be milked to yield 100 pounds of milk, but only 1.5 to 2 cows are needed to produce the same amount.

Paradoxically, families who are willing to make the labor commitment to a small scale dairy operation are often under capitalized. One of the cash requirements for a dairy operation is feed. The producer believes the use of perennial grasses will lower feed costs.

Once established, perennials eliminate the yearly purchases of seed, yearly tillage costs, chemical herbicides and replanting expenses. Native warm-season perennials are reputed to require less water and fertilizer than annuals and produce more biomass per acre. Due to deep and extensive root systems they are also believed to be quite drought tolerant.

This producer proposes to lower the cost of feed in order to increase the longevity of her small-scale dairy. She will do this by reducing total inputs and by improving the productivity of the land by using native warm-season perennial grass crops as sources of hay for her dairy.

Objectives

1.) Determine if warm season perennial grasses that mature at successive dates throughout the season will produce more, and better quality, hay for dairy goats than does the currently used sorghum/sudan cross.

Approach

The producer will plant a thirty-acre plot of sorghum/sudan grass cross. She will harvest it and feed it to her dairy goats. She will also plant three 10-acre plots with one of the following warm season grasses respectively; *Tripsacum dactyloides* (eastern gamma grass), *Sorghastrum nutans* (indian grass) and *Panicum virgatum* (switch grass). The three warm season grasses will be harvested as hay (in boot stage) and fed to dairy goats.

The producer will take soil samples from the plots prior to planting and after harvests of all grasses and analyze them for pH, CEC, nitrogen, phosphorus, potassium and some micronutrients. She will take samples from all hay species and analyze them for yield, protein content, macronutrients and some micronutrients.

She will keep records of monthly sampling of percent butterfat, percent protein and total production, of milk from goats fed the sorghum/sudan cross hay for one lactation cycle (one year) and then hay from the three warm season perennials for one lactation cycle (one year). She will also keep records of costs associated with production of hay from all types of grasses.

Outreach

A dairy goat field day will be held in cooperation with the Texas Agricultural Extension Service for Travis County. The field day will offer practical information on the impact of perennial grasses on the economics of a small-scale dairy. Attendees will be able to view demonstration plots of warm season perennial grasses. A publication summarizing the project will be submitted to an appropriate journal.

Project area

Grazing systems

Project duration

3 years

Budget:

SARE	$9,640
ACE	
Matching	$13,169

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Identification of Cover Crops to Enhance Habitat for Specific Beneficial Insects in Sustainable Production Systems

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Farmers are reporting great success in California in their efforts to reduce both the need for insecticides and for the repeated release of beneficial insects. They have accomplished this by developing plant mixes that attract and retain beneficial insects and by sowing and mowing these mixes at the appropriate times during the growing seasons.

There is great potential for similar programs in North Carolina. However, there is little information available in the region on relationships between specific beneficial insects and the appropriate plant species that would attract and retain them. The producer intends to develop this type of information. If successful, he believes that there would be great potential for local production of cover crop seed mixes and the consequent reduction in the use of insecticides.

Objectives

1.) Develop information on selected cover crop species that can provide habitat for beneficial insects for vegetable production and a cotton-peanut rotation in North Carolina.

2.) Determine if inserting the selected cover crops into existing vegetable and/or peanut-cotton rotation increases the presence and activity of beneficial insects and reduces the need for intervention.

Approach

The grower has put together a team consisting of a farmer, several extension agents, a nonprofit representative, a cover crop researcher and an entomologist. They will conduct a database search to find references to cover crops, cover crop mixes and their associated beneficial insects, and management schemes for the crops/mixes and beneficial insects. In this search they will look for what has been done with cover crop/beneficial insect systems in other regions.

Based on the advice from this team of experts, the grower will select plants with the appropriate suite of potential beneficial insects and select the best planting dates. The team will meet six times throughout the life of project. They will develop proper planting schedules, rates, spacing and monitoring procedures. The grower will use an experimental design to ensure that the results are due to the experimental treatments rather than to random chance. The grower will plant the selected species and varieties and keep records of all project activities.

The grower will recruit farmers and insect scouts to attend joint NCDA and NCSU scouting training. From this process a scout will be trained to conduct bi-weekly insect monitoring, scouting and evaluation throughout two growing seasons. The grower will document all stages of the project with videotape and/or slides.

Outreach

The team will host a field day with farmers recruited from all the commodities involved. The grower will participate in conferences, distribute press releases and conduct other outreach activities as identified by the team of experts.

Project area

Beneficial Insects

Project duration

2 years

Budget:	
SARE	$8,452
ACE	
Matching	$5,750

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Multiple On-Farm Use of Aquatic Plants and Animals

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Many small farmers find it difficult to earn a living wage. Moreover, the increasing costs of farming and low return on capital make it difficult for new farmers to get started. The grower has designed a project that will help overcome these barriers by utilizing existing ponds and water sources to grow aquatic plants and animals.

Many farms already have ponds or water sources that are seldom utilized for growing cash crops. Many different aquatic plants have economic value as food for human consumption, animal fodder, and for sale as garden ornamentals. Furthermore, aquatic and bog plants are some of the best known filters for purifying water, and they also recycle nutrients. This is increasingly important for farms that raise livestock or have problems with nutrient leaching and runoff.

Objectives

1.) Improve water quality and decrease input costs by using aquatic plants to recycle nutrients and water back into the farm system.

2.) Increase farm income by using aquatic plants and animals as additional cash crops.

Approach

This project will recycle runoff from animal pens, and domestic greywater through a series of filter beds, utilizing aquatic plants, to capture nutrients and cleanse the water.

The grower will develop a duck/tilapia/aquatic plant system in which the ducks and tilapia eat the aquatic plants. In turn, the ducks and tilapia will fertilize the water and the aquatic plants.

The grower will use some aquatic plants (water hyacinths and duckweed) as alternative feed for pigs and chickens. He will market other aquatic plants as vegetables (duck potato, watercress, water spinach, water chestnut) and ornamentals (water lilies, lotus, water lettuce, bulrushes).

Outreach

The grower will conduct a field day and workshop. He will submit the results of the project to permaculture journal and farm publications. The results will be publicized through the local extension service.

Project area

Aquaculture

Project duration

2 years

Budget:

SARE	$9,575
ACE	
Matching	$12,100

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Group Strategic Alliances for Carroll County Feeder Calves

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Carroll County, Kentucky, is located on the Ohio River halfway between Louisville, Kentucky and Cincinnati, Ohio. In 1994, over 93 percent of crop receipts for the county came from tobacco.

These tobacco growers report that they are under pressure to consider alternative or supplemental crops to tobacco. However, Carroll County has a unique combination of barriers that make trying alternatives difficult. Once you leave the bottoms, the slopes get quite steep—71 percent of the land has slopes of 12 percent or greater. Because of the county's prime river location, farming is giving way to industry on that land.

The Carroll County Cattlemen's Association (CCCA) has concluded that livestock produces the best supplemental income, given their reliance on tobacco and their particular geographic and economic circumstances. They have determined that in order for producers to increase their incomes from cattle they must be willing to do two things: 1.) provide a favorable product and 2.) try marketing alternatives.

The Carroll County Cattlemen's Association will make their cattle more marketable by improving the carcass quality through breeding and management systems. By forming marketing groups, they hope to be in a better bargaining position with feedlots and packers.

Objectives

1.) Identify breeding and management systems that improve carcass quality and facilitate marketing of cattle by the Carroll County Cattlemen's Association.

2.) Develop standards for marketing cattle from Carroll County, Kentucky, during the next five years.

3.) Develop marketing contacts for the Carrol County Cattlemen's Association (CCCA).

Approach

The CCCA will gather growth and feed data on each calf. This will take two breeding seasons (approximately 18 to 20 months). During the first year, all CCCA producers will complete a Total Quality Management program. The program will cover five areas of beef production: 1) issue awareness 2) preventative health practices, cattle working facilities and animal handling techniques 3) breeding management 4) nutrition and health 5) marketing.

All CCCA producers will complete questionnaires identifying current management practices, breeding background of their cow herds, personal goals for their beef cattle program, what they want to accomplish by participating in the project and the investment they will need to make in bulls and facilities. Producers will also be required to utilize Cow Herd Appraisal Software (CHAPS) and will be instructed on its use.

A committee from the CCCA will develop a program for each producer that will enumerate breeding, nutrition, management and health programs in order to create uniform lots of cattle. Contracts between the CCCA and each producer will be drawn to provide the producer with detailed instructions to develop his or her herd to CCCA standards.

Outreach

The CCCA will conduct marketing field days in conjunction with the Kentucky Department of Agriculture Marketing Division. These field days will showcase the cattle being marketed. Extension specialists will share the program information during producer workshops throughout the state.

Project area
Marketing

Project duration
2 years

Budget:

SARE	$10,000
ACE	
Matching	$58,700

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Technical Assistance for Meat Goat Marketing

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The major cash crop in Owsley County, Kentucky is tobacco and its production has been declining. A study conducted by the Kentucky Long Term Policy Research Center has predicted that in the 10 years from 1993 to 2003 tobacco production will decline by 41 percent.

A group of concerned citizens serving as the Owsley County Action Team joined together to study sustainable alternatives for their area. They identified meat goat production and marketing in the eastern coastline region as one alternative. The East Kentucky Goat Producers Association (EKGPA) was formed to further develop this alternative.

While the EKGPA is convinced the potential for meat goat production exists, information about marketing is scarce. Consequently, the EKGPA has decided that research into marketing is needed for meat goat production to be successful in Owsley County.

Objectives

1.) Promote the efforts of the EKGPA to educate farmers and prospective farmers on meat goat production and marketing.

2.) Demonstrate proper artificial insemination methods, selection of meat goat varieties, goat management and pasture management through field days and publications.

3.) Visit and network with goat producers, marketers, slaughterhouses and processing plants to learn about the latest meat goat management, marketing technology and potential markets.

Approach

The EKGPA will write and submit a series of newspaper articles describing their planned activities and inviting participation. They will attend Southeast Regional Meat Goat Association meetings to develop contacts and learn the newest technologies and marketing ideas. They will then conduct a goat farming workshop.

The EKGPA will conduct field days on artificial insemination and conduct pasture management demonstration projects. They will then analyze the data from pasture management demonstration projects. Following the data analysis they will conduct a field day on pasture management. They will also visit slaughterhouses and processing plants in order to thoroughly understand market criteria they will have to meet.

Outreach

The EKGPA will produce a brochure and newsletter of their activities. They will also publish and distribute a handbook of information on meat goat production and marketing in eastern Kentucky.

Project area

Marketing

Project duration

2 years

Budget:

SARE	$8,900
ACE	
Matching	$4,062

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Grasslands Matua and Grasslands Gala in the Tennessee Valley as an Alternative to Fescue and Ryegrass

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All from Mississippi State University

Soil erosion concerns and the desire of farmers to lower input costs have increased demand for new species and varieties of forage grasses. New forage species from New Zealand and from the western United States have been introduced, but research on their suitability for the southern United States is scarce.

Two exotic grasses (Grasslands Matua and Grasslands Gala) have been touted as alternatives to fescue and ryegrass. In addition, Gala is reputed to exhibit nearly 12 month growth in the south and withstand intense grazing with quick recovery.

The producer will test the suitability of the two grasses for his dairy operation in an effort to identify alternatives to ryegrass and fescue in the south.

Objectives

1.) Determine if *Bromus Willdenowii* (kunth) prairie grass (Grasslands Matua) and *Bromus Stamineus* Desv. (Grasslands Gala) produce acceptable forage for dairy cows, especially during the hot and humid months.

2.) Determine if Grasslands Matua and Grasslands Gala can be used as an alternative to fescue and ryegrass.

Approach

The farmer will establish two acres each of Grasslands Matua and Grasslands Gala as well as corresponding plots of fescue and ryegrass. Four groups of approximately 10 cows will be grazed on the four plots i.e., one group each on Matua, Gala, ryegrass and fescue.

On a one- to two-week schedule he will take grass samples from all four plots. They will be analyzed for forage quality including protein content, macronutrients and some micronutrients. Percent butterfat, percent protein and total milk production from cows grazed on all four plots also will be analyzed. The grower will measure biomass since this will provide total production data and is the actual measure of what will be available to his cows.

Outreach

The producer will produce a publication each year from that year's project results. He will also conduct a tour stop for the local Cattleman's Association fall field day to discuss the project and results. He will also disseminate project data when he attends other field days and meetings throughout the year.

Project area

Grazing systems

Project duration

3 years

Budget:

SARE	$9,900
ACE	
Matching	$4,050

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Low Input Sustainable Agriculture Short Course

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The number of farmers has declined in the Chattanooga, Tennessee, area. There is also a lack of information supporting sustainable agriculture techniques for existing and prospective farmers. This grower proposes to address the decrease in the number of farmers by developing a workshop on sustainable agriculture that will help beginning farmers succeed.

Area supermarkets acquire nearly all of their fresh produce and meat through distribution systems that buy from suppliers all over the world. Not surprisingly, there are only two market farmers in the Chattanooga area. Both are certified organic growers who produce a variety of fruits and vegetables. A small number of specialty farmers continue to produce fresh fruit on a limited basis.

The grower will plan, market and conduct a comprehensive short course on sustainable agriculture in the Chattanooga area. Through this course he will emphasize intensive farming practices utilizing low inputs for small and limited-resource farmers.

This project will directly address the problem of the decreasing agricultural base in the area. By providing sustainable agriculture options for those wishing to enter agriculture as a career, he will expand the availability of fresh local food for the Chattanooga area.

Objectives

1.) Conduct a 40-hour short course on low-input sustainable agriculture for existing large- and small-scale farmers and to potential farmers.

2.) Communicate issues linked to agriculture through farmers, land-use planners and conservationists.

Approach

The short course will include information on plant physiology, soil texture and structure, crop planning and rotation, planting and tillage techniques, composting, organic pest management and marketing. The techniques taught will be part of a total system showing course participants how to grow more food per acre.

The section on tillage practices will demonstrate how to improve crop yield by increasing soil fertility, texture, structure and organic matter. It will cover the use of compost and how to make it from animal manures and crop residues. The unit on pest control will integrate biological controls with common cultural practices. The course will also cover selective harvesting of hardwoods, preservation of habitat and use of native species.

The marketing section will cover direct sales to consumers through farm stands, community supported agriculture (CSA) groups, farmers' markets and value-added products. The course will stress the use of on-farm resources and the reduction of off-farm inputs to increase net farm income.

The course covers the following topics.

1. Soil modules
    a. Soil physical properties
    b. Soil organic matter
    c. Soil management
    d. Soil biology
    e. Composting
    f. Soil testing
    g. Soil amendments
2. Plant-soil modules
    a. Photosynthesis
    b. Plant-soil relationships
    c. Plant-nutrient uptake
    d. Plant-water relations
    e. Nutrient cycles
    f. Pest and disease management
    g. Native plants as agriculture
3. Marketing
4. Workshops
    a. Tools and tool maintenance
    b. Layout and bed preparation
    c. Community gardens
    d. Composting
        i. Materials
        ii. Construction
        iii.Management
    e. Fertilization
        i. Soil
        ii. Foliar
        iii.Compost amendments
        iv. Vermicomposting
    f. Planting and transplanting
    g. Plant propagation
    h. Weed control
    I. Pest and disease observations
    j. Season extending techniques.

Cooperators

Mary K. Daugherty
Natural Resources Conservation Service

Linda Harris
Tennessee Valley Authority

Sandra L. Kurtz
Global Action Plan
Chattanooga Community Planning Commission

Ann Coulter
Chattanooga/Hamilton County Regional Planning Commission

James C. Brown
Tennessee River Gorge Trust

Jeanne Brice
Chattanooga Goodwill Industries Inc.

Georgiana Kotarski
Chattanooga Area Food Bank

Liz O'Conner
Chattanooga Area Food Bank Community Gardening Program

Project area
Education

Project duration
2 years

Budget:

SARE	$9,650
ACE	
Matching	$16,650

Outreach

Information and results from the course will be distributed through press releases to local news media and by publication in each cooperator's newsletter. Cooperators will also distribute information about availability of local produce and generate further interest in the course. Projects initiated as a result of the course will be used for annual farm tours and as demonstration sites.

SARE
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Southern Region

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Sustainable Cultivation of Medicinal Herbs as a Cash Crop Alternative to Tobacco

Project Coordinator

Paul D. Miller
Tamsen Farm
1253 Pressman's Home Rd.
Rogersville, TN 37857

Ph: (423) 272-5163

Cooperators

E.W. "Buddy" Sanders
Douglas E. Dalton
Wesley Neal Denton
All University of Tennessee
Cooperative Extension
Service.

Johnny Sandefur
Natural Resources
Conservation Service

This grower's small farm in Hawkins County in Northeast Tennessee is typical of many small farms throughout the southern appalachian region. This is particularly true with respect to the problems it faces in achieving and maintaining economic viability. These problems include:

* small tillable acreage
* marginal soils damaged by erosion and past management practices
* soils deficient in organic matter and available mineral nutrients
* declining revenue from, and uncertainty about future of, burley tobacco
* inability to make sufficient wages from farm income, requiring off-farm employment.

The majority of farmers in Tennessee rely on a small number of crops: tobacco, soybeans and corn as well as cattle. Small farmers increasingly are finding it difficult to compete with large farms in the production of these conventional crops. In the case of tobacco, some evidence suggests that the large companies are moving some of their operations to other countries where production costs are lower.

Due to these reasons and to the increasing public sentiment against smoking in the United States, many small farmers are looking for crops that can be grown as alternatives or additions to tobacco. The Tennessee Farm Bureau has informed growers that if they intend to grow alternative crops to tobacco they must consider the following challenges:

* Demand for some crops is limited
* Established producers are likely to resent new competition.
* Some crops are more apt to fail and more likely to experience wide price swings than others.
* Some crops won't grow well in particular soils or geographic regions.
* Local institutions may lack expertise with the crop, making advice and research scarce.
* There may be no way to effectively market the crop.

This producer plans to investigate the feasibility of growing *Echinacea purpurea,* purple coneflower as a cash crop in northeast Tennessee. He chose this herb for this project because:

* It has a high market value (sells for $7-$12 per pound.
* It has high expected crop yields. Estimates of up to 1200 pounds of dried root per acre have been obtained.
* There is a growing U.S. market and a very strong European market for *E. purpurea.*
* *E. purpurea* is a native plant species that is adapted to local conditions.
* It is adaptable to existing equipment and facilities of the region, e.g., tobacco barns, setters, cultivators, etc.
* It is highly adaptable to organic/sustainable growing methods.

Objectives

Determine the practicality and economic feasibility of producing organically grown *Echinacea purpurea*, a high-value cash crop, as an alternative to tobacco in northeast Tennessee.

Approach

The grower will keep detailed records on the amounts and types of compost, manures and cover crops used in the project. He will also determine the acreage harvested, average yield per acre, total crop production, marketing year average, and the total value of the production for *E. purpurea* and other medicinal herbs that show promise.

The grower will compile yield and production data on *E. purpurea* grown in east Tennessee. The grower will also compile tobacco production data from east Tennessee. This information, along with the tobacco cultivation results from the grower's farm, will be used as a control for the research to determine if growing *E. purpurea* can offer a practical and cost-effective alternative to tobacco in east Tennessee.

The project crop will be undersown with white dutch clover/ladino clover/native short grasses to keep down weeds and to serve as refugia for beneficial insects. The grower will monitor the crop for insects, both harmful and beneficial, disease, weeds, and response to climate and cultural practices.

Project area

Alternative crops

Project duration

3 years

Budget:

SARE	$5,004
ACE	
Matching	$4,650

Problems with insects, disease, and cultural practices will be addressed by approved organic methods.

To avoid reliance on one market, the grower will develop multiple markets for *E. Purpurea.* He will also develop markets that will allow direct brokering without retailing.

Outreach

The grower will work with extension faculty to develop a handout on the cultivation of *E. purpurea* and other medicinal herbs. The handout will also cover pest and disease management and marketing. He will hold a field day in conjunction with the NRCS in Hawkins County and the Hawkins County Agricultural Extension agent. The grower and cooperators will submit papers to *Organic Gardening, Herb Quarterly, HerbalGram, Common Ground, Southern Sustainable Farming,* and *Tennessee Farm Bureau News.* They will also submit proposals to participate through speaking or workshop at the Southern Sustainable Agriculture Working Group Annual Conference and the Tennessee Flower Growers Annual Conference.

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Alternatives to Chemicals in the Peanut-Cotton Rotation

Project Coordinator
Hubert Morris
Rt. 2 Box 20
Halifax, NC 27839

Ph: (919) 583-2801

The peanut-cotton rotation is the major production system for many farmers in eastern North Carolina. Cotton production alone increased 40 percent from 1994 to 1995, up to nearly 800,000 acres in North Carolina. One hundred and fifty thousand acres of peanuts are grown in North Carolina, primarily in 13 counties in the coastal plain.

The production of both peanuts and cotton are chemical intensive and costly. Thirty-three percent of the operating inputs in peanut production go to pesticides. Both peanut and cotton production depend on the use of chemicals, which are known or suspected carcinogens.

In the past, peanut growers who own or rent quota have been guaranteed a price based on the cost of production through the Federal Peanut Program. If the price of peanuts drops or the program is discontinued, a significant loss of income will result for farmers, and some of them could go out of business.

As growers have looked for ways to improve their cultural techniques, become more efficient, and stay competitive, many have adopted no-till methods of production. Peanut growers received some benefits from the switch to no-till production, but they had to increase use of chemicals.

This project will evaluate beneficial insects, cover crops and less toxic chemicals as alternatives for various chemical products currently used. For cotton, the grower will investigate the use of alternatives to Pix, a growth regulator which encourages the initiation of reproductive growth, and Def, a defoliant used just before harvest. For peanuts, the grower will investigate alternatives to Aldicarb (Temik), which is used for early-season thrips control. The farmer will evaluate sugar water to replace Pix, citric acid to replace Def, and beneficial mites and soaps to control thrips.

Objectives

1.) Determine the efficacy of using beneficial mites and soaps to control thrips on peanuts in eastern North Carolina.

2.) Determine the efficacy of using sugar water and citric acid to replace Pix (growth regulator which encourages initiation of reproductive growth) and Def (defoliant) respectively on cotton in eastern North Carolina.

Approach

Beneficial mites (to control thrips in peanuts) will be released in one-half of the experimental areas on the grower's farm and the farms of four project cooperators. Soap sprays (to control thrips in peanuts) will be used in the other half of the experimental areas on those farms.

The fields receiving these treatments will be monitored for amount of thrips damage and peanut yields. Since treatments will be adjoining, buffer strips will be used. Data on thrips damage and peanuts harvested from the experimental areas inside the buffer strips will not be used.

Sugar solution (as a growth regulator) will be applied to cotton in the pinhead square stage in experimental areas on the grower's farm and the farms of two cooperators. Sugar solution will be reapplied as needed. At 40 percent open bolls, citric acid solution will be applied as a defoliant to cotton in the experimental areas on the project farms. Citric acid will be reapplied as necessary.

The initiation of reproductive growth due to the application of the sugar solution will be compared with that caused by Pix. The amount of defoliation caused by citric acid applications will be determined and compared with the amount of defoliation caused by Def. Cotton yields from experimental areas will be determined and compared with yields in non-experimental areas. Buffer strips will be used, and data from the strips will not be included.

Outreach

The Cooperative Extension Service and the NRCS will publish the results of the project in agency newsletters as well as in local newspapers. In addition, they will hold field trips so that interested individuals can view the project. Project results will be disseminated through a series of farmer meetings organized throughout the region by RAFI-USA.

Cooperators

Shelton Lyles
Rusty Harrell
David Mayer
John Rollins

Arthur Whitehead
Halifax County
Cooperative Extension
Service

Wayne Short
Halifax County
Natural Resources
Conservation Service

Scott Marlow
Rural Advancement
Foundation International

Project area
Beneficial insects
Alternatives to chemicals

Project duration
2 years

Budget:
SARE $9,366
ACE
Matching $9,450

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Sustainable Agriculture Research and Education
Southern Region

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Annual Report
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Grazing Alternatives to Tall Fescue for Stocker Cattle

Project Coordinator

Chris Pitts
Rt. 1 Box 616
Erin, TN 37061

Ph: (615) 289-5225

Cooperators

Edgar Brown
Montgomery County
Cooperative

Louis Langell
USDA-AMS
Livestock & Grain Market
News Service

Jack Milton
Jim Looft
Gary Bates
Tim Cross
All Cooperative Extension
Service
University of Tennessee

David May
Great Bend Feeding Inc.

Feeder/stocker cattle from the southeast are perceived by some buyers as lower quality and less healthy than cattle from other regions. This results in lower prices being offered to southeastern growers. Consequently, producing cost-efficient and healthy feeder cattle is a prime concern to growers.

Much research has been conducted on improving forage grasses, but there have been varying degrees of adoption in upper middle Tennessee. This is often because forage species developed as alternatives for other regions of the country usually have higher costs and/or increased management requirements over the commonly used tall fescue.

Tall fescue provides excellent production in the fall and spring but leaves much to be desired in the summer. When stocker cattle graze endophyte-infected tall fescue during the summer months, they generally exhibit reduced daily weight gains and a less desirable appearance. These cattle take longer to start gaining weight on rations at feedlots, have more health problems than those grazed on other forage and bring discounted prices.

The producer has noticed that even a limited introduction of crabgrass into a local tall fescue grazing system provides measurable improvement in marketability, summer weight gains, feedlot performance and profitability. Crabgrass is economical to produce, adaptable and naturally occurring. It has the potential to work well in rotations with wheat and ryegrass, eliminating the need to tie up land year-round to produce summer grazing as some other species require.

This producer intends to integrate forage species based on their seasonal production to provide maximum grazing. By blending forage species to suit land quality and area limitations he will be able to provide maximum grazing forage for his livestock.

Objectives

1.) Determine if a crabgrass (in summer) and wheat/ryegrass (in winter) forage for stocker cattle will reduce the cost of beef production and improve health, carcass quality and marketability over cattle grazed on endophyte-infected tall fescue in the southeastern United States.

Approach

Purchased stocker cattle will be randomly divided into two groups. Each group will be grazed rotationally on either tall fescue (with some clover lezpedeza) or crabgrass and wheat/ryegrass until they weigh approximately 750 pounds (3 - 6 months). The grazing rotations will be based on forage availability using temporary fencing where feasible.

Forage availability estimates will be determined and stocking rate data will be collected. Excess forages will be harvested as hay and total yield will be determined. The producer will take forage samples on a regular basis and analyze them to determine the nutritional quality of the two forage groups.

The producer will have the cattle weighed as they are sorted to a grazing system and thereafter at thirty day intervals. He will collect data on average daily weight gain, field feed conversion estimates, individual performance relative to initial efficiency, total feed conversion, carcass quality and other pertinent performance data of the stocker cattle.

Outreach

The producer will hold a field day focusing on the topics of forage and beef cattle. He will also arrange tours for agribusiness groups and producers from Tennessee and adjoining states. With the assistance of his cooperators he will prepare and distribute extension fact sheets on the results of the project.

Project area

Grazing systems

Project duration

3 years

Budget:

SARE	$9,982
ACE	
Matching	$79,114

Administrative Council

1996 Membership

Adell Brown
Southern University
Louisiana

Rob Myers
SARE Program Director
USDA/CSREES
Washington, DC

D.C. Coston
Agricultural Experiment Station
Oklahoma State University
Stillwater, OK

Charles A. Onstad
USDA/ARS
Texas

David Foster
Cooperative Extension
Arkansas

Charles Panton
North Carolina A & T
North Carolina

Tim Hale
US Geological Survey
Georgia

Jerry Pennick
Federation of Southern Cooperatives
Georgia

Alex Hitt
Producer
North Carolina

Melbah Smith
MS Association of Cooperatives
Mississippi

James Horne
Kerr Center for
Sustainable Agriculture
Oklahoma

Tom Trantham
Producer
South Carolina

Arnold King
Natural Resource Conservation
Service
Texas

Gene Turpin
Producer
Kentucky

Rick Kocurek
Producer
Texas

Donald Voth
Univ. of Arkansas
Arkansas

Bryce Malone
Dept. of Agriculture & Forestry
Louisiana

Harry Wells
Pollution Prevention Office
USEPA
Washington, DC

Lorna McMahon
Producer
Tennessee

Savanah Williams
Producer
Virginia

Duties

The Southern Region SARE Administrative Council is responsible to the Secretary of Agriculture through the CSREES-ES partnership. Specific responsibilities are to:

* Appoint a regional host institution and regional coordinator subject to the approval of the USDA;
* Make recommendations to the USDA concerning research and education projects that merit funding;
* Promote sustainable agriculture research and education programs in the Southern Region;
* Establish goals and criteria for the selection of projects within the Southern Region;
* Appoint a Technical Advisory Committee for evaluation of proposals for projects to be considered for funding
* Review and act upon the recommendations of the Technical Advisory Committee and coordinate its activities with the host institution;
* Prepare and make available an annual report concerning Southern Region activities in sustainable agriculture.

Membership

Terms of membership are for three years, with approximately one-third rotating off each year. The membership of the Administrative Council includes:

* Farmers/ranchers practicing sustainable agriculture, including farmers/ranchers representing Best Utilization of Biological Applications and representing Integrated Management Systems;

* Nonprofit organizations with demonstrable expertise in sustainable agriculture including organizations representing Best Utilization of Biological Applications and organizations representing Integrated Management Systems;

* Agribusiness with demonstrable expertise in sustainable agriculture

* Representatives from the following:
  - USDA Agriculture Research Service
  - USDA Cooperative State Research Education and Extension Service
  - US Environmental Protection Agency
  - Natural Resource Conservation Service
  - State agency representing sustainable agriculture
  - State agricultural experiment stations
  - State Cooperative Extension Services
  - US Geological Survey

* Other persons knowledgeable about sustainable agriculture and its impact on the environment and rural communities.

Technical Advisory Committee

Duties

The primary goal of the committee is to provide guidance to the Southern Region SARE program concerning the technical merit of proposals and projects. The committee provides recommendations for funding based on technical merit through the Project Review Committee to the Administrative Council.

* Evaluate preproposals and full proposals submitted to the SARE program.

* Participate in project and program reviews.

* Work with the Project Review Commmittee and Host Institution on developing appropriate proposal and project evaluation guidelines.

Membership

Terms of membership are for three years, with approximately one-third of the members rotating off the committee each year.

Members are appointed by the Adminstrative Council from the following sectors:

* Farmers/ranchers who practice sustainable agriculture, including farmers/ranchers representing Best Utilization of Biological Applications and representing Integrated Management Systems;

* Nonprofit organizations with demonstrable expertise in sustainable agriculture including organizations representing Best Utilization of Biological Applications and organizations representing Integrated Management Systems;

* Agribusiness with demonstrable expertise in sustainable agriculture

* Representatives from the following:
  - USDA Agriculture Research Service
  - USDA Cooperative State Research Education and Extension Service
  - US Environmental Protection Agency
  - Natural Resource Conservation Service
  - State agency representing sustainable agriculture
  - State agricultural experiment stations
  - State Cooperative Extension Services
  - US Geological Survey

* Other persons knowledgeable about sustainable agriculture and its impact on the environment and rural communities.

1996 Membership

Samuel Bass
South Carolina State Univ. Ext.

Kome Onokpise
Florida A&M University

Viviana Carro
University of Puerto Rico

Jim Pease
Virginia Tech

Barry Colley
Arkansas Land & Farm Devel. Corp.

Chris Ramcharan
Agricultural Experiment Station
University of the Virgin Islands

Billy Higgenbotham
Prairie View A&M
Coop. Ext. Service
Texas

M. R. Reddy
North Carolina A&T University

Christopher Hunte
Southern University
Louisiana

David Redhage
Kerr Center for Sustainable Agriculture
Poteau, OK

Larry Jeffries
Producer
Kentucky

Glenn Richardson
Producer
Texas

Ira Linville
EPA, Region IV
Georgia

Craig Rothrock
University of Arkansas

Richard Lowrance
USDA
Georgia

Edward Segerson
North Carolina A & T

Glenn Mackie
County Extension
Kentucky

John R. Simpson
South Carolina State College

Teresa Maurer
ATTRA
Arkansas

Tina Gray Teague
Arkansas State University

Dale Monks
Extension Weed Science
Auburn University

Jim Thomas
Mississippi State Univ.

George Naderman
North Carolina State Univ.

Jim Worstell
Delta Land and Community, Inc.
Arkansas

Mack C. Nelson
Fort Valley State College
Georgia

Robert Zabawa
Tuskegee University
Alabama

Active SARE Projects

Project #	Project Title	Lead Institution	Project Coordinator	SARE Funds	Matching Funds
LS93-51	Warm-Season Forage Grasses as Rotations for Sustaining Profitable Peanut Production	Auburn University	R. Rodriguez-Kabana	$ 183,000	$ 48,500
LS93-52	Utilization of Dairy Manure in Low-Input, Conservation Tillage Animal Feed Production Systems	University of Tennessee	Michael Mullen	$ 90,635	$ 36,123
LS93-53	Sustainable Whole Farm Grain/Silage Production Systems for the Southeast	Auburn University	Wayne Reeves	$ 240,639	$ 218,600
LS93-54	Evaluation of Low-Input, No-Till, No-Herbicide Continuous Grazing System for Grazing Cows	Clemson University	Jean Bertrand	$ 118,911	$ 62,700
LS93-55	Cover Crop Integration into Conservation Production Systems for Cotton and Sorghum	USDA/ARS	Seth Dabney	$ 135,540	$ 117,040
LS93-56	Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production (Also AS93-9)	University of Georgia	Craig Sheppard	$ 2,150	$ 513
LS94-57	Disease and Insect Management Using New Crop Rotations for Sustainable Production of Row Crops	University of Georgia	Barry Cunfer	$ 152,200	$ 52,614
LS94-58	Post-CRP Land Management and Sustainable Production Alternatives for Highly Erodible Lands in the Southern Great Plains	USDA/ARS	Thanh Dao	$ 196,100	$ 90,000
LS94-59	Assessing the Impact of Beneficial Insects on Organic Farms (Also AS94-13)	North Carolina State University	George Kennedy	$ 17,735	See AS94-13
LS94-60 LS95-60.1	Integration of Animal Waste, Winter Cover Crops, and Biological Antagonists for Sustained Management of Columbia Lance and Other Nematodes on Cotton	North Carolina State University	Kenneth Barker	$ 46,721 96,691	$ 12,356 24,593
LS94-61	Integrating Sustainable Forestry into Whole Farm Management of Minority and Limited-Resource Landowners in Three Regions of Arkansas	Winrock International	Nick Brown	$ 246,710	$ 159,086
LS94-62	Intercropping Small Grains and Lupin for Sustainable On-Farm Utilization	Auburn University	Edzard van Santen	$ 143,151	$ 164,759
LS94-63	Regional Center for Sustainable Dairy Farming	North Carolina State University	Steve Washburn	$ 180,497	$ 127,924

Active SARE Projects

Project #	Project Title	Lead Institution	Project Coordinator	SARE Funds	Matching Funds
LS94-64	Development of Sustainable Area-Wide Weed Management Practices for Improved Land Utilization (Continuation of AS93-8)	University of Tennessee	Jerome Grant	$ 3,760	See AS-93-8
LS95-65	Wildlife Enhancement (Also AS95-18)	North Carolina State University	Peter Bromley	$ 98,205	See AS95-18
LS95-66	Control for Citrus Mites (Also AS95-19)	Univ. of Florida	Carl Childers	$ 50,512	$ 52,000
LS95-67	The Development of Pasture-Based Swine Production Systems for Limited Resource Farms in the Mississippi Delta	Arkansas Land and Development Corporation	Bryan Stevens	$ 274,412	$ 68,852
LS95-68	Using Farm Family Case Studies to Teach Sustainable Agriculture	University of Tennessee	Tim Cross	$ 146,630	$ 137,090
LS95-69	Managing Soil Phosphorous Accumulation From Poultry Litter Application Through Vegetable/Legume Rotations	Texas A&M	D.R. Earhart	$ 135,000	$ 90,813
LS95-70	Effects of Organic and Chemical Fertility Inputs on Soil Quality In Limited Resource Vegetable Farms	Virginia Tech	Greg Evanylo	$ 184,319	$ 79,351
LS95-71	Developing Municipal/On-Farm Linkages for On-Farm Composting and Utilization of Yard Wastes	Virginia Tech	Greg Evanylo	$ 69,167	$ 24,522
LS95-72	Agronomic and Economic Benefits of Intercropping Bean with Banana	University of Puerto Rico	Lii-chyuan Liu	$ 98,845	$ 50,239
LS96-73	Soil Conservation and Pest Management Impacts of Grass Hedges	USDA-ARS	S. Dabney	$ 137,352	$ 79,500
LS96-74	Improving Integrated Resource Management Skills of Beef Producers	Oklahoma State University	D. Doye	$ 163,642	$ 330,313
LS96-75	Developing Sustainable Crop Management Systems for Improving Production of Culinary Herbs in the Virgin Islands	University of the Virgin Islands	M. Palada	$ 143,529	$ 64,420
LS96-76	Integration of Pastured Poultry Production Into the Farming Systems of Limited Resource Farmers	Heifer Project International	S. Polson	$ 149,624	$ 141,500
LS96-77	Development of Sustainable Cropping Systems for Seedless Watermelon and Fall Lettuce in Rotation with Green Manures	North Carolina A&T State University	M.R. Reddy	$ 182,751	$ 94,129

Active SARE Projects

Project #	Project Title	Lead Institution	Project Coordinator	ACE Funds	Matching Funds
LS96-78	Saving the Southern Legacy:Heirloom Plants and Local Knowledge for Profitable, Sustainable Agriculture.	University of Georgia	R.E. Rhoades	$ 152,817	$ 100,748
LS96-79	Multi-Cropping Cattle and Watermelon in the Southern Plains.	Oklahoma State University	W. Roberts	$ 54,752	$ 49,600
LS96-80	Implementation of Alternative Agriculture Strategies for Rural Community Sustainable Development Northampton County, Virginia	The Nature Conservancy	T. Thompson	$ 228,517	$ 101,098
LS96-81	Controlling Cheat and Annual Ryegrass in Small Grains Using Novel Crop Harvesting Technologies (Also listed as AS96-25)	Oklahoma State University	T.F. Peeper	$ 83,624	See AS96-25

Active ACE Projects

Project #	Project Title	Lead Institution	Project Coordinator	ACE Funds	Matching Funds
AS92-2	Habitat Enhancement for Beneficial Insects in Vegetable and Fruit Systems	Rodale Institute	Janet Bachmann	$ 200,000	$ 79,975
AS93-8	Development of Sustainable Area-Wide Weed Management Practices for Improved Land Utilization (Continued as LS94-64)	University of Tennessee	Jerome Grant	$ 161,240	$ 133,000
AS93-9 (also LS93-56)	Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production	University of Georgia	Craig Sheppard	$ 49,100	$ 12,300
AS93-10	Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study (Continued from LS91-39A)	University of Arkansas	David Miller	$ 100,000	$ 64,043
AS93-11 AS94-11.1	Use of Poultry Litter or Manure for Root-knot Nematode Management on Vegetables and Field Crops (Continued as AS94-11.1)	Clemson University	Bruce Fortnum	$ 99,900 $ 46,792	$ 81,000 $ 54,000
AS93-12	Waste Management Systems for Loafing Areas in Dairies	Clemson University	David Brune	$ 68,613	$ 26,540
AS94-13	Assessing the Impact of Beneficial Insect Populations on Organic Farms (Also LS94-59)	North Carolina State University	George Kennedy	$ 37,207	$ 14,068
AS94-14	Forage, Biomass and Biogas Integrated Systems for Animal Waste Management	Texas Ag. Exp. Station	M. J. McFarland	$ 101,180	$ 157,894
AS94-16	Development of Guidelines for and Demonstration of Efficient Treatment of Swine Lagoon Wastewater by Constructed Wetlands	Auburn University	Tom A. McCaskey	$ 130,325	$ 78,553
AS95-18	Wildlife Enhancement and Education as Catalyst in the Widespread Implementation of Sustainable Ag Practices (Also LS 95-65)	North Carolina State University	Peter Bromley	$ 75,000	$202,904
AS95-19	Development of Biological Control Methods for Citrus Rust Mites and Spider Mites on Florida Citrus Utilizing Predaceous Arthropods (Also LS95-66)	University of Florida	Carl Childers	$ 75,000	$ 35,000
AS95-20	The Utilization of Natural Enemies, Viral Insecticides and Improved Information Delivery for Management of Lepidopterous Pests in Developing Transgenic Cotton	Clemson University	Sam Turnipseed	$ 37,820	$ 46,759
AS95-21	Reduced Risk Cockroach Control in Confined Animal Production	North Carolina State University	Coby Schal	$ 38,840	$ 15,889

Active ACE Projects

Project #	Project Title	Lead Institution	Project Coordinator	ACE Funds	Matching Funds
AS95-22	Biological Control of Silverleaf Whitefly and Fungus Gnat in Poinsettia Production	University of Georgia	Mary Harris	$ 45,389	$ 11,250
AS95-23	Increasing Acceptance of Low Input Landscapes for the Southeast	University of Georgia	S. Kristine Braman	$ 36,826	$ 15,980
AS95-24	Identifying Pesticides Most Compatible With Parasites of the Citrus Leafminer	University of Florida	Marjorie Hoy	$ 33,125	$ 24,487
AS96-25 (Also LS96-81)	Controlling Cheat and Annual Ryegrass in Small Grains Using Novel Crop Harvesting Technologies	Oklahoma State University	T.F. Peeper	$ 125,000	$ 248,935

Active Producer Projects

Project #	Project Title	State	Project Coordinator	SARE Funds	Matching Funds
PG94-5	Vegetable Marketing Strategies for a Small Farm Co-op	South Carolina	Sea Islands Farm Co-op	$10,000	$1,850
PG94-10	Site Specific Applications of Seed/ Fertilizer/Chemicals	Texas	Ricky Meinen	$10,000	$20,900
PG94-11	Clover Clippings as Replacement for Chicken Litter in Compost	Alabama	Jean Mills	$6,160	$6,040
PG94-14	Cut Flowers as a Sustainable Agricultural Alternative	Oklahoma	Judy Schroeder & Vicki Stamback	$6,000	$3,100
PG95-20	No-Till Vegetable Demonstration	Virginia	Linford Belcher	$8,300	$17,200
PG95-21	Pecan IPM Using Black-Eyed Peas as a Trap Crop	Texas	Kyle Brooksheir	$4,000	$4,098
PG95-22	No-Till Grain Production for Soil and Moisture Conservation	Oklahoma	Bob Dietrick	$9,818	$19,636
PG95-23	No-Till Cotton Production Using Best Management Practices	Mississippi	Charles Donald	$8,295	$53,280
PG95-24	Alternative Control of Soil Diseases in Vegetable Production	Virginia	Dennis Dove	$5,625	$4,060
PG95-25	Development of Potting Soil Mixes from Local Wastes	Florida	Steve Garrison	$9,600	$13,800
PG95-26	Testing the Efficacy of Alternative Methods of Whitefly Control in Organic Vegetable Production	Florida	Rosalie Koenig	$5,200	$1,875
PG95-27	High-Value, Small-Scale Sustainable Vegetable and Fruit Production Methods	North Carolina	Larry & Judy McPherson	$9,612	$4,942
PG95-28	Improving Tropical Soils by Utilizing Organic Wastes	Puerto Rico	Andre Rene Sanfiorenzo	$10,000	$20,400
PG95-30	Management of Artificial and Restored Wetlands to Improve Water Quality	Florida	A. Glenn Simpson	$10,000	$45,200
PG95-31	Improving Quality of Slaughter Hogs as a Marketing Strategy for Small Producers	Kentucky	Bluegrass Pork Producers	$9,150	$17,300
PG95-32	Native Pecan Orchard Management Using Best Management Practices	Arkansas	Bill Wilson	$ 5,986	$ 13,700
PG95-33	Cover Crops in Integrated Vegetable Production Systems	South Carolina	Charles Wingard	$ 9,285	$ 11,315

Active Producer Projects

Project #	Project Title	State	Project Coordinator	SARE Funds	Matching Funds
PG95-34	Hydroponic Vegetable Production in Conjunction with a Trout Farming Operation	North Carolina	Carl Zeitlow	$ 9,975	$ 6,425
PG96-35	Aquaculture Conversion Model for Poultry and Hog Facilities Emphasizing Building Re-use and Recycled On-Farm Resources	North Carolina	Benny Bunting	$ 6,000	$ 74,064
PG96-36	Can Organically Managed Native Warm Season Grasses Provide a Sustainable and More Cost Effective Hay Source for a Family Operated Goat Dairy than Input Intensive Annual Sorghum/Sudan Grass Crosses?	Texas	Lee B. Dexter	$ 9,640	$ 13,169
PG96-37	Identification of Cover Crops to Enhance the Habitat of Specific Beneficial Insects in sustainable production systems	North Carolina	Kenny Haines	$ 8,452	$ 5,750
PG96-38	Multiple On-Farm Use of Aquatic Plants and Animals	North Carolina	Harvey Harman	$ 9,575	$ 12,100
PG96-39	Group Strategic Alliances for Carroll County Feeder Calves	Kentucky	Tim Hendrick	$ 10,000	$ 58,700
PG96-40	Technical Assistance for Meat Goat Marketing	Kentucky	Neil Hoffman	$ 8,900	$ 4,062
PG96-41	Grasslands Matua and Grasslands Gala in the Tennessee Valley as an Alternative to Fescue and Ryegrass.	Mississippi	Tulon McKee, Jr	$ 9,900	$ 4,050
PG96-42	Low Input Sustainable Agriculture Short Course	Tennessee	Alexander McGregor	$ 9,650	$ 16,650
PG96-43	Sustainable Cultivation of Medicinal Herbs as an Alternative to Tobacco as a Cash Crop.	Tennessee	Paul D. Miller	$ 5,004	$ 4,650
PG96-44	Alternatives to Chemicals in the Peanut Cotton Rotation	North Carolina	Hubert Morris	$ 9,366	$ 9,450
PG96-45	Grazing Alternatives to Tall Fescue for Stocker Cattle	Tennessee	Chris Pitts	$ 9,982	$ 79,114

Active Professional Development Projects

Project #	Project Title	Lead Institution	Project Coordinator	SARE Funds	Matching Funds
LST94-1 and 95.8	Southern Region Sustainable Agriculture Training Consortium	North Carolina State University	Roger Crickenberger	$199,620	$14,875
LST94-2	Environmentally and Economically Sustainable Use of Rangeland	Texas A&M University	J.F. Cadenhead	$72,570	$72,570
LST94-4	Sustainable Dairy Systems Manual and Training	University of Tennessee	Clark Garland	$90,000	$277,920
LST94-5	Sustainable Cotton Production for the South	Auburn University	Elizabeth Guertal	$10,000	$11,898
LST96-9 (Cont. of LST94-3)	Management Intensive Grazing: Foundation of Sustainable Agriculture in the South	University of Southwestern Louisiana	H.Alan Deramus	$97,233	$109,463
LST96-10	Sustainable Small-Scale Agricultural Development Training Project	Southern University	Adell Brown	$ 25,701	$ 25,701
LST96-11	Southern Gathering on Agricultural Problem-Solving	University of Kentucky	R.J. Hustedde	$ 52,000	$ 52,000
LST96-12	Facilitating Farmer to Farmer Networks: An Experimental Approach	University of Florida	Marilyn E. Swisher	$ 80,997	$ 80,997
LST96-13	Sustainable Agricultural Marketing through Collaborative Policy Development	Delta Land and Community, Inc.	James V. Worstell	$ 40,900	$ 40,900

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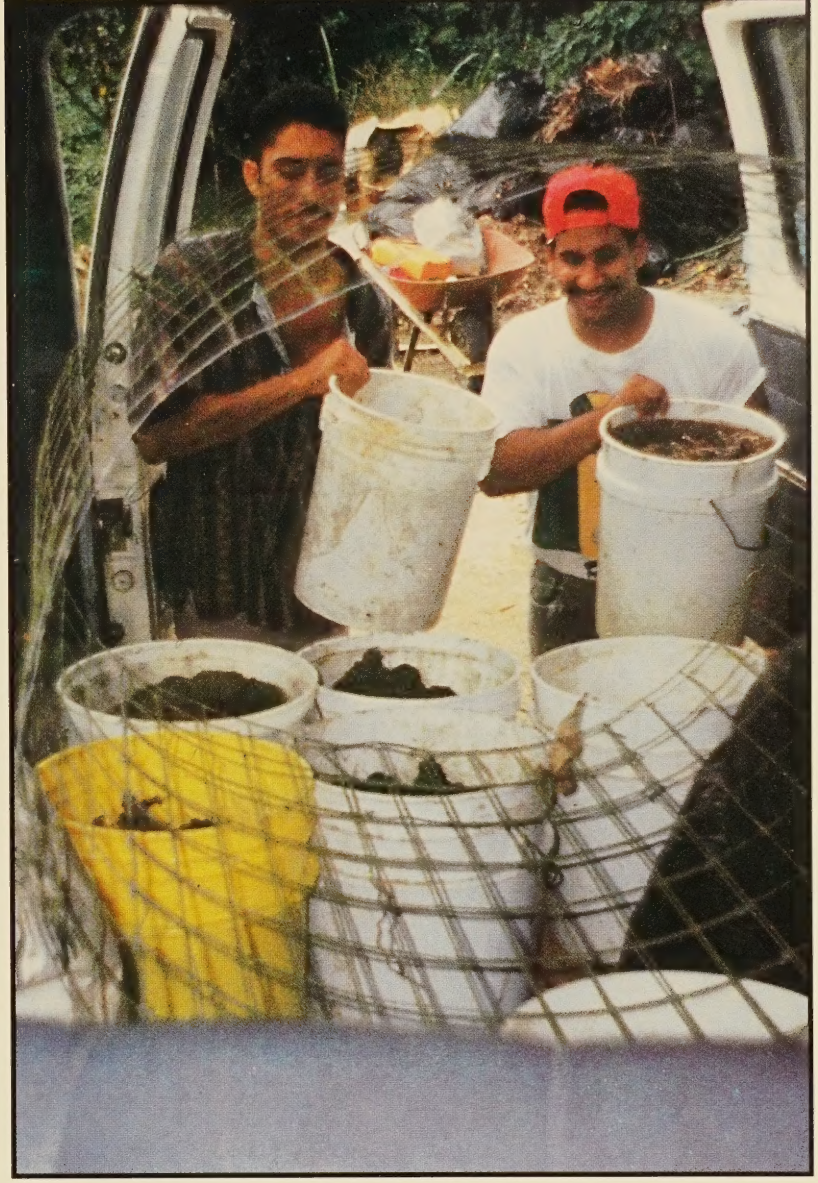
Front cover photos:

Top right: Extension agents fired up the Texas range during a prescribed burning session as part of a Professional Development Program training project in rangeland management. Photo by J.F. Cadenhead. (Project LST94-2).

Bottom right: Research assistant Paulino Perez (left) points out a chive plant to be measured by Reinardo Vasquez, while horticulturist Errol Chichester records the data. The SARE research conducted through the University of the Virgin Islands will support the production and marketing of culinary herbs by local farmers. Photo by Manuel Palada. (Project LS96-75).

Bottom left: Jerry Brannock counts a producer's hogs before loading them as part of a cooperative marketing effort by the Bluegrass Pork Producers of eastern Kentucky. Improving carcass quality is also a part of this Producer Grant project. (Project PG95-31).

Top left: Sharon White and Wayne McLamb collect forage samples as part of the sustainable dairy system project at North Carolina State University. Photo by Steve Washburn. (Project LS94-63.)



Joel Colon and Heriberto BeLeon pack composting materials into a van for a portable demonstration to other farmers in Puerto Rico. Farmers in this Producer Project are learning to make compost from local products including waste from a citrus processing plant and a poultry operation. Photo by Andre Sanfiorenzo. (Project PG95-28).

Acknowledgments

The Southern Region 1996 Annual Report was accomplished through a cooperative effort in keeping with the SARE philosophy. Writing, editing and design were done by Gwen Roland. Project summaries were written by the project coordinators. Proofreading was done by Steven Michael Jones. Project photos were taken by project participants or Gwen Roland. Printing was done by Southern States Printing of Griffin, Georgia.

This document was prepared with the support of USDA Agreement No. 93-COOP-1-8885. Any opinions, findings, conclusions or recommendations expressed herein do not necessarily reflect the views of the USDA. The USDA prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status.

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Dr. Barbra Diffay, extension veterinarian from Tuskegee University and Rosa Shareef, farmer participant from Mississippi, help clean up after chicken processing at Joel Salatin's Polyface Farm in Virginia. Heifer Project International (HPI) is coordinating the pastured poultry project based on Salatin's successful model. Other cooperators include ATTRA, Kentucky State University, Louisiana's Southern University and eleven farm families.

As they enter the second year of the project, the farm families have raised their first flock of chicks and following the HPI tradition have "passed along the gift" of a flock of chicks to another farm family. Some have even recruited new families to join the project. Photo by Skip Polson of Heifer Project International. (Project LS96-76)